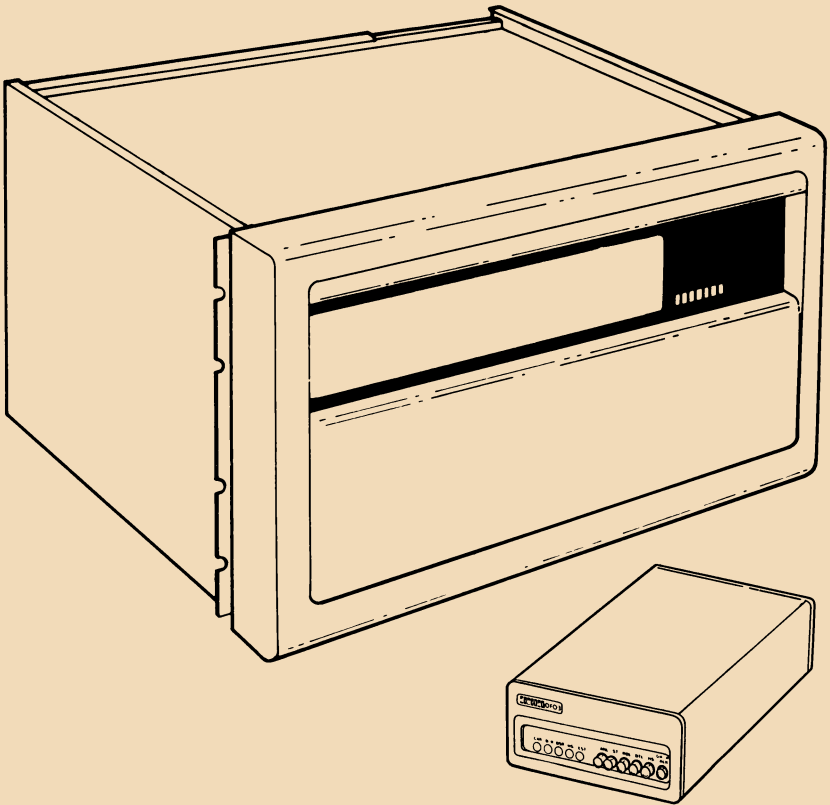


DF03 Modem Family User Guide



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DF03 Modem Family User Guide

Prepared by Educational Services
of
Digital Equipment Corporation

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PREFACE

This manual provides technical information that enables the user to install, test, and operate the Standalone DF03 Modem and the Rack Mount DF03 Modem.

Chapter 1 provides a physical description, functional overview, feature summary, and interface data for the standalone and the rack mount DF03. Chapter 2 contains procedures for proper site setup and installation of both units. Chapter 3 describes the different controls and indicators, describes all modes of operation for both standalone and rack mount features, and includes examples of programming for the auto call unit. Chapter 4 contains a step-by-step sequence of test procedures used to correctly verify modem operations. These procedures are common to both standalone and rack mount units. Chapter 5 describes the optional configurations that are available on the standalone and the rack mount modems and the jumper/switchpack selections to implement selected options. Chapter 6 identifies actions that should be taken when service is required.

The selections listed in Chapter 5 are presented in tabular format. Each modem module is shipped from the factory with these options preset to select the most popular variation. In the tables describing these options, factory settings are printed in blue for easy reference. Other areas of this manual are printed in blue to bring attention to certain features and conditions.

CANADIAN RESTRICTION

The Standalone DF03 Modem is not certified by the Canadian Department of Communications (DOC) for operation in Canada.

The DF-100 rack assembly, with DF03-RA/RC modems, is certified for Canadian use.

CANADIAN APPLICATION NOTICE

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an approved method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified jack-plug-cord ensemble (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations. Existing telecommunications company requirements do not permit their equipment to be connected to customer-provided jacks except where specified by individual telecommunications company tariffs.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure (for their own protection) that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves but should contact the appropriate electric inspection authority, or electrician, as appropriate.

CHAPTER 1

INTRODUCTION

1.1 GENERAL

This chapter contains a physical description, a functional overview, a list of general specifications, and a feature summary for the Standalone DF03 Modem, and the Rack Mount DF03 Modem.

Depending upon the application, the standalone DF03 and the rack mount DF03 have distinct advantages. In configurations where data communications volume is low, one or two standalone modems would satisfy the requirement. However, in a high-volume communications environment, where several modems are required, the concentrated packaging of the DF100-RM rack mount assembly would be more suitable and cost efficient. The diagram of Figure 1-1 provides a simple view of both high- and low-volume applications.

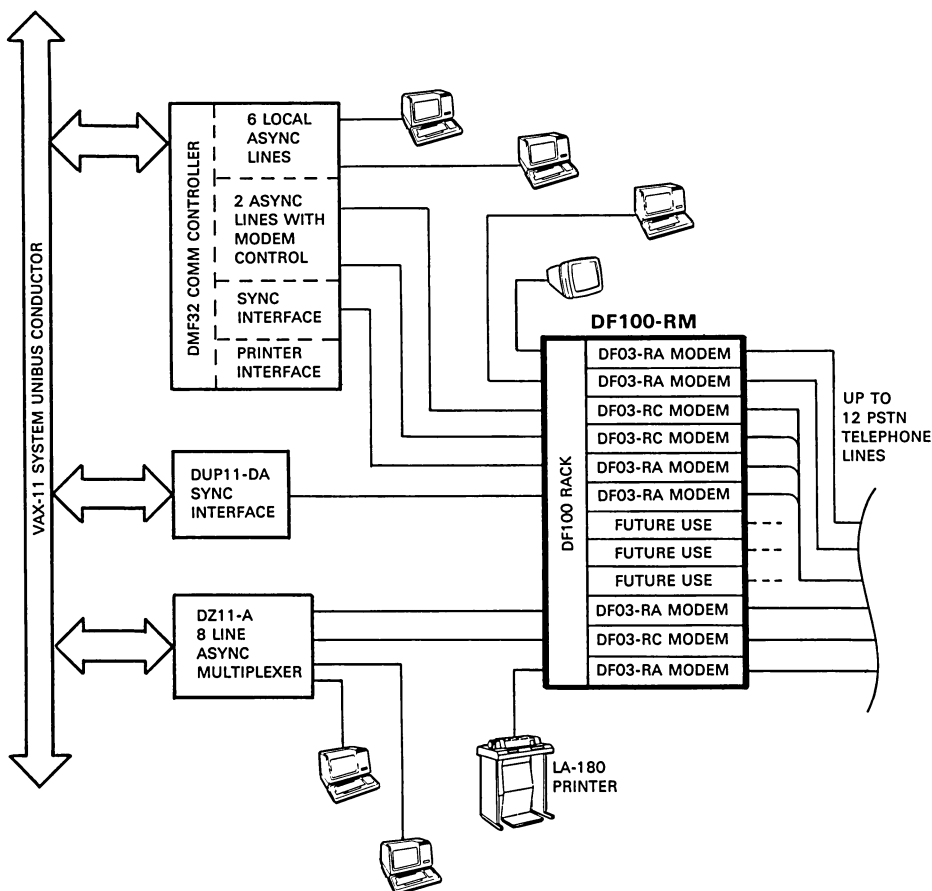
1.2 PHYSICAL DESCRIPTION

The Standalone DF03 Modem contains the electronics to provide one channel of data communications while the Rack Mount DF03 Modem contains up to twelve modem boards. Functionally, both units are identical.

1.2.1 Standalone DF03

The Standalone DF03 Modem (Figure 1-2) houses up to three different modules: the telephone line interface module that contains the power supply, the M7177 Auto Call Unit (ACU) module, and the M5800 modem module. Each module is a field-replaceable unit. The DF03 front panel consists of five Light-Emitting Diodes (LEDs) and six pushbuttons. The LEDs are used to determine modem status, while the pushbuttons are used to select different modes of operation and implement a variety of test features to verify proper modem operation. The standalone DF03 is available in the two basic models listed below.

- DF03-AA – Standalone modem without auto call, including the telephone line interface module and modem module.
- DF03-AC – Basic modem with auto call, same as above plus the ACU module.



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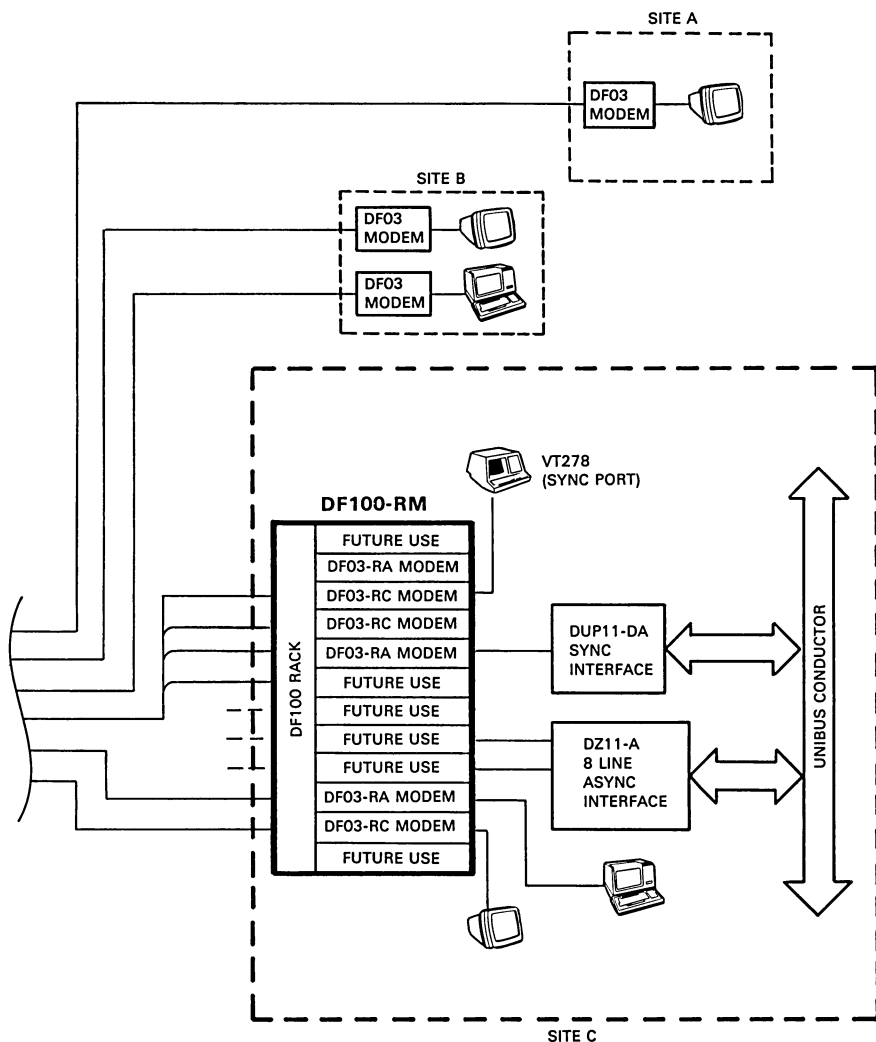
Figure 1-1 DF03 Modem Applications (Sheet 1 of 2)

1.2.2 Rack Mount DF03

The Rack Mount DF03 Modem (Figure 1-3) contains all of the functionality of the standalone modem plus the advantage of lower cost because the modem modules use a common power supply and rack enclosure that houses up to 12 individual modems.

The rack mount modem enclosure, with internal power supply, is called the DF100-RM. The DF100-RM enclosure fits in any standard 48.26 cm (19 in) rack configuration.

The DF100-RM also houses an optional power regulator module called the DF100-PR. Should one regulator fail, the dual regulator feature allows automat-

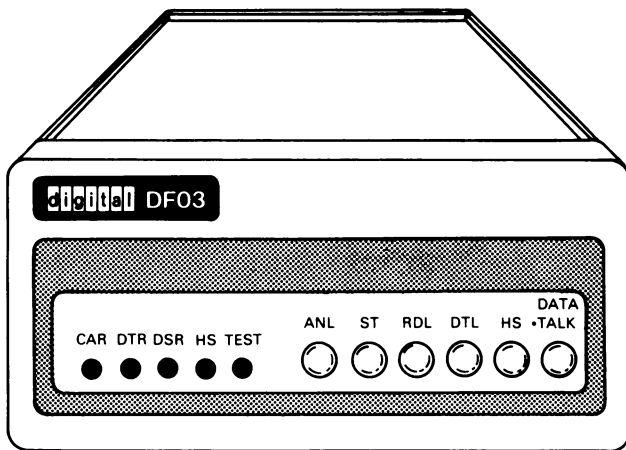


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Figure 1-1 DF03 Modem Applications (Sheet 2 of 2)

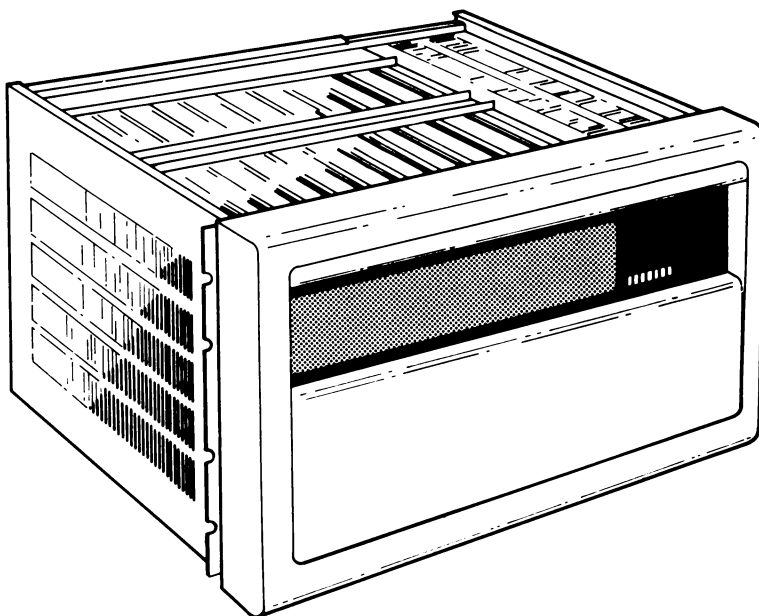
ic switchover to the other regulator. Notification of a power regulator failure is indicated when any of the four LEDs on the module is OFF.

To prevent short circuits, the DF100-RM features a power supply protection circuit. If (for any reason) one of the outputs is shorted, the system shuts down. All power supply LEDs, except for POWER STATUS, are OFF. Once the shorted condition is corrected, the regulator(s) is reset by placing the ON/OFF power switch to the OFF position, then back to the ON position.



MK-1593

Figure 1-2 Standalone DF03 Modem



MK-4184

Figure 1-3 Rack Mount DF03 Modem

The basic DF03 rack mount modem (without auto call) is referred to as a DF03-RA which is a single card modem module. The same modem module, with an auto call module attached to it, is referred to as the DF03-RC. Rack modem products available are:

- DF100-RM – Rack mount enclosure, including power supply;
- DF100-PR – Optional redundant power regulator module for DF100-RM;
- DF03-RA – Rack mount DF03 modem module (without ACU);
and
- DF03-RC – Rack mount auto call DF03 modem module (DF03 with attached auto call module).

1.3 FUNCTIONAL OVERVIEW

The DF03 converts serial binary data, generated by the Data Terminal Equipment (DTE), into frequency encoded audio tones and transmits the tones over the telephone lines. Conversely, it converts the audio tones from remote stations into serial binary data and routes the data to the local data terminal equipment. The DF03 provides full-duplex, asynchronous or synchronous, binary serial data communications over two-wire switched-telephone network facilities. Low-speed operation [0 to 300 bits per second (b/s)] is asynchronous, binary Frequency Shift Keying (FSK). High-speed operation (1200 b/s) is either character-asynchronous or bit-synchronous, Quaternary Differential Phase Shift Keying (QDPSK). The DF03 is functionally compatible with the Bell System 103J™ and 212A™ Data Sets. A standard Bell System telephone set, or its equivalent, is used to manually originate and answer calls.

To establish communications between a remote location and a local data terminal, the DF03, when equipped with the automatic call unit module, automatically dials the number desired and establishes communications using serial binary data supplied through the EIA interface. The auto call feature is explained in Section 3.4.

1.4 GENERAL SPECIFICATIONS

Specifications for the Standalone and Rack Mount DF03 Modems are listed below.

1.4.1 Standalone Modem

Height	69 mm (2.7 in)
Width	143 mm (5.6 in)
Length	277 mm (10.9 in)

103J™ and 212A™ are trademarks of Western Electric.

Weight DF03-AA/AC Module Size	2.3 kg (5 lbs 1 oz) Standard dual height boards
Operating Temperature	5°C to 50°C (41°F to 122°F) Free air (normal convection)
Storage Temperature	−40°C to +66°C (−40°F to +150°F)
Relative Humidity	0% to 95% noncondensing, noncaustic
AC Input Power	120 Vac, 60 Hz (nominal) Operates at an input from 104 to 128 Vrms at 57 to 63 Hz with a maximum input current of 115 mA at 128 Vac. The input power is 13.7 VA. The primary input is protected by an externally accessible 0.250 A fuse.
Data Rate	
Low Speed	0 to 300 b/s asynchronous format
High Speed	1200 b/s +1% to −2.5% asynchronous character format 1200 b/s synchronous format
Modulation	
Low Speed	Frequency Shift Keying (FSK)
High Speed	Quaternary Differential Phase Shift Keying (QDPSK)
Format	
Low Speed	Asynchronous, binary, serial
High Speed	Character-asynchronous format or bit-synchronous format, binary, serial
Mode	Two-wire, frequency-multiplexed, full-duplex
Interface	EIA RS-232-C compatible voltages for standalone modems. Distance up to 15.25 m (50 ft).

Signal Detect

Turn ON	155 ms (± 50 ms after receiving line signal)
Turn OFF	17 ms (± 7 ms after loss of line signal)

1.4.2 Rack Mount Enclosure

Same as above, except for the following.

Height	267 mm (10.5 in)
Width	483 mm (19.0 in) standard rack size
Depth	343 mm (13.5 in) card cage assembly
Weight	12.25 kg (27 lb) without modem modules or optional power regulator.

AC Input Power	120 Vac, 60 Hz (nominal), single phase Operates at an input from 90 to 128 Vrms at 57 to 63 Hz with a maximum input current of 700 mA at 120 Vac (approximately 40 mA for each modem module and 210 mA for the power regulator). Input is protected by a 2.5 A circuit breaker.
----------------	--

Interface	EIA RS-232-C/RS-423-A compatible voltages for rack modems. Distances up to 61 m (200 ft).
-----------	---

Interface Connector	25-pin Cinch™ connector for both standalone and rack modems.
---------------------	--

1.4.2.1 DF03-RA/RC Modem Modules –

Size	Standard grid finger board 264.2 mm $\times$ 203 mm (10.4 in $\times$ 8 in)
Weight	DF03-RA = 0.680 kg (1.5 lbs) DF03-RC = 0.907 kg (2.0 lbs.)

1.4.2.2 DF100-PR Power Regulator Module –

Size	203 mm $\times$ 158.7 mm (8 in $\times$ 6.25 in) including the heat sink
Weight	DF100-PR = 0.907 kg (2.0 lbs)

Cinch™ is a trademark of TRW, Inc.

1.4.3 Auto Call Unit

The Automatic Call Unit (ACU) is provided by a dual height M7177 PCB. The module complies with the environmental conditions listed above and is used on both the standalone DF03-AC and the rack mount DF03-RC. However, the DF03-RC requires an M7177 Rev. (F) or later, while the DF03-AC accepts any M7177.

Other characteristics associated with auto call are:

Data Rate	Supports 110, 300, or 1200 b/s asynchronous ASCII data format.
Interface Connection	Normal asynchronous EIA data port of the modem.
Commands	Control B (CTRL/B) = Initiates call and prepares modem for telephone number.
	Control A (CTRL/A) = Aborts a call before the call is established.
	Control C (CTRL/A) = When preceded by CTRL/B, redials the previous telephone number.
	Equal Sign (=) = Access pause character holds dialing for intermediate dial tone detection.
Dial Tone	Recognizes 350 Hz to 650 Hz dial tone
Answer Tone Abort	Aborts call if answer tone is not detected within 27 to 52 seconds after initiating a call (CTRL/B).

1.5 FEATURE SUMMARY

The following features are available with the DF03 modem family.

1.5.1 Dual Application Modem

The standalone and rack mount DF03 modems support either 300/1200 b/s asynchronous applications or 1200 b/s synchronous applications. Auto call, auto answer, front panel status lights, and test features make the DF03 modem family a full-featured product.

The auto call feature allows for automatic dialing of remote stations using either attended terminal control or unattended program control.

1.5.2 FCC/DOC Approved

The DF03 modem family is FCC registered, conforms to Part 15 requirements, and is approved for direct connection to public switched telephone networks according to FCC Part 68. The DF03 rack modem is certified by the Canadian Department of Communications (DOC).

1.5.3 Packaging

The standalone DF03 modem is contained in a compact, lightweight package that is compatible with the size of a standard telephone (this allows the phone to be placed on top of the modem). The rack enclosure is a space saver (requires 267 mm [10.5 in] of vertical rack space) with accommodations for up to 12 modem modules. It uses convection cooling for quiet operation and allows for easy expansion. The enclosure connects to either a Public Switched Telephone Network (PSTN) or to private/leased lines on a line-by-line basis. All DF03 modem products meet UL and CSA requirements.

1.5.4 Configuration

The DF03 modem family provides the user with the ability to modify a variety of modem configuration variables by changing switches. This allows the user to quickly adapt to a wide range of communication applications without added cost. The DF03 modem can be used for both voice and data communications with a standard telephone by using the front panel DATA/TALK (D/T) switch.

The DF03 rack modem also supports cabling distances up to four times the standard EIA RS-232-C distance of 15.25 m (50 ft).

1.5.5 Installation and Service

Installation is quick and easy; just a few cables and the DF03 modem is ready. Rack modem modules plug directly into the DF100 enclosure without disrupting power or cabling. All of the DIGITAL modem products are backed by their worldwide service network. DIGITAL field service offers a variety of on-site and off-site maintenance programs.

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CHAPTER 2 SITE PREPARATION AND INSTALLATION

2.1 GENERAL

The DF03 is approved by the U.S. Federal Communications Commission (FCC) for direct connection to the telephone network. Only the rack mount DF03-RA is certified for Canadian use. Regulatory requirements outlined in Section 2.2 must be observed before installing the DF03 Modem.

2.2 REGULATORY AGENCY REQUIREMENTS

Government controlled communication regulatory agencies require that devices (such as modems) attaching to telephone lines must comply with certain regulations concerning use of standard plugs and jacks, as well as other operational and protective requirements.

Prior to installation, it is necessary to contact the local telephone business office and request data communications service for installation of customer-provided equipment. You must specify the following information that is found in paragraphs 2.2.1 or 2.2.2.

- Type of communication service required to support customer provided equipment (RJ11C or RJ21X).
- Indicate the number of telephone circuits (lines) required with service.
- FCC registration or DOC certification number and the ringer equivalence number.

NOTE

When installing a DF100-RM modem rack assembly, an interconnecting cable is required to attach the DF100-RM to the RJ21X service. Generally, this cable is supplied by the telephone company in a length of 5.2 m (15 ft). If the telephone company does not supply this cable with the service, then the cable must be ordered. The correct cable type is a Western Electric B25A™ cable or equivalent. Careful consideration must be given to the location of the RJ21X service. For details see Section 2.5.2.

2.2.1 FCC Regulations

2.2.1.1 FCC Part 68-Direct Connection – The chart below contains FCC information on the DF03 that must be given to the telephone company when telephone service is requested for U.S. installations.

U.S. Installations

Topic	Standalone DF03	Rack Mount DF03
FCC Registration Number	AO994Q-69391-DM-R	AO994Q-64162-DM-R
Ringer Equivalence Number	0.3A	0.3B
Type of Service	Single line with RJ11C connector	12 public switched lines terminated in RJ21X connector block

2.2.1.2 FCC Part 15J Certification for DF03-AA/AC – The DF03-AA/AC generates and uses radio frequency energy. If this equipment is not installed and used in strict accordance with the instructions in this manual, it may cause interference with radio and television reception. The DF03-AA/AC was type tested and complies with the limits for a Class B computing device according to Part 15, Subpart J, of the FCC rules. These rules are designed to provide reasonable protection against interference when operated in a residential environment. If this equipment does cause interference with radio or television reception, determined by turning the equipment OFF and ON, the user is encouraged to correct the problem by trying one or more of the following measures.

B25A™ is a trademark of Western Electric.

- Reorient the receiving antenna.
- Move the equipment around or away from the receiver.
- Plug the equipment into a different outlet so that the equipment and receiver are on different branch circuits.

If the above measures fail, the user should consult a dealer or an experienced radio/television technician. “How to Identify and Resolve Radio-TV Interference Problems”, a booklet prepared by the FCC, is also recommended. This booklet is obtainable from the US Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

2.2.1.3 FCC Part 15J Verification for DF03-RA/RC – The DF03-RA/RC generates and uses radio frequency energy. If this equipment is not installed and used in strict accordance with the instructions in this manual, it may cause interference with radio and television reception. The DF03-RA/RC was tested and verified to comply with the limits for a Class A computing device according to Part 15, Subpart J, of the FCC rules. These rules are designed to provide reasonable protection against interference when operated in a commercial environment.

2.2.2 DOC Regulations

The chart below contains DOC information that must be given to the telephone company when telephone service is requested for Canadian installations.

Canadian Installations

Topic	Standalone DF03	Rack Mount DF03-RA
DOC Certification Number	N/A	192 286 A
Permissive Mode of Operation	N/A	Load Number: 38
Type of Service	N/A	12 public switched lines terminated with a Type O connection

2.3 OPERATING ENVIRONMENT

2.3.1 Standalone DF03 Modem

The standalone DF03 modem operates within temperatures ranging from 5°C to 50°C (41°F to 122°F) and a relative humidity ranging from 0% to 95% noncondensing. Normal air convection is sufficient for cooling. Nominal power required is 13.7 volt amperes at 120 volts, 60 Hz. The power supply withstands input voltage changes ranging from 90 Vac to 128 Vac. The input line frequency can change from 57 Hz to 63 Hz without having an effect on the operation of the DF03. The maximum input current of 115 milliamperes occurs at 128 Vrms.

2.3.2 Rack Mount DF03 Modem

The operating environment for the DF03 rack mount modems is basically the same as the standalone except for the following.

The normal power required for a fully configured DF100-RM with DF03-RC modems is 84 volt amperes at 120 volts (700 mA), 60Hz, single phase. Each DF03-RA or RC modem module draws about 40 milliamperes of current from the common power supply. Maximum DF03 configuration generates 297 BTU/hr.

2.4 UNPACKING AND INSPECTION

Remove all packing materials and check the equipment with the shipping list. Inspect the unit for damage as it is removed from the carton. Check for dents, scratches, and loose parts. Be particularly careful to inspect cables, plugs, and connectors for bent pins, crushed wires, and damaged insulation. Check the carton for small parts that may have fallen off. Damage to the unit and shortages in package inventory should be reported to the shipper at once.

2.5 INSTALLATION

This section describes the installation procedure for both the standalone and rack mount DF03 modems. The site preparation considerations are: compliance with environmental specifications and ordering the correct telephone service.

Place the standalone DF03 in a convenient location (shelf, desk top, and so on) so that it conforms to the maximum cabling distances and it is in easy access to ac power.

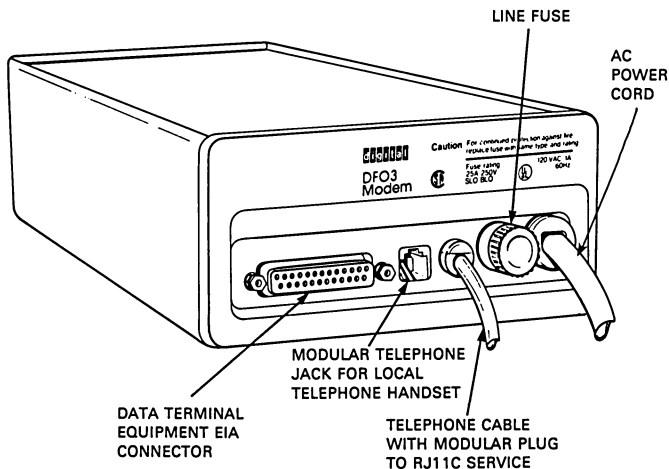
The DF100-RM rack enclosure may be placed in any standard 48.26 cm (19 in) cabinet and in easy access to ac power. Do not place either unit in or near electrically noisy equipment thus affecting Part 15 of the FCC rules.

NOTE

1. Digital Equipment Corporation does not recommend connecting the DF03 to a key telephone system because it can cause a line disturbance. If you have a key telephone system, your local telephone equipment supplier can advise you about modifications allowing the DF03 connection to the telephone line (so that the service unit is not disturbed).
2. Both standalone and rack mount DF03 modem PCB modules are factory configured for compatibility with most data communications equipment. However, in some cases it may be necessary to select different options. For option selection guidelines, see Chapter 5.

2.5.1 Standalone DF03 Installation

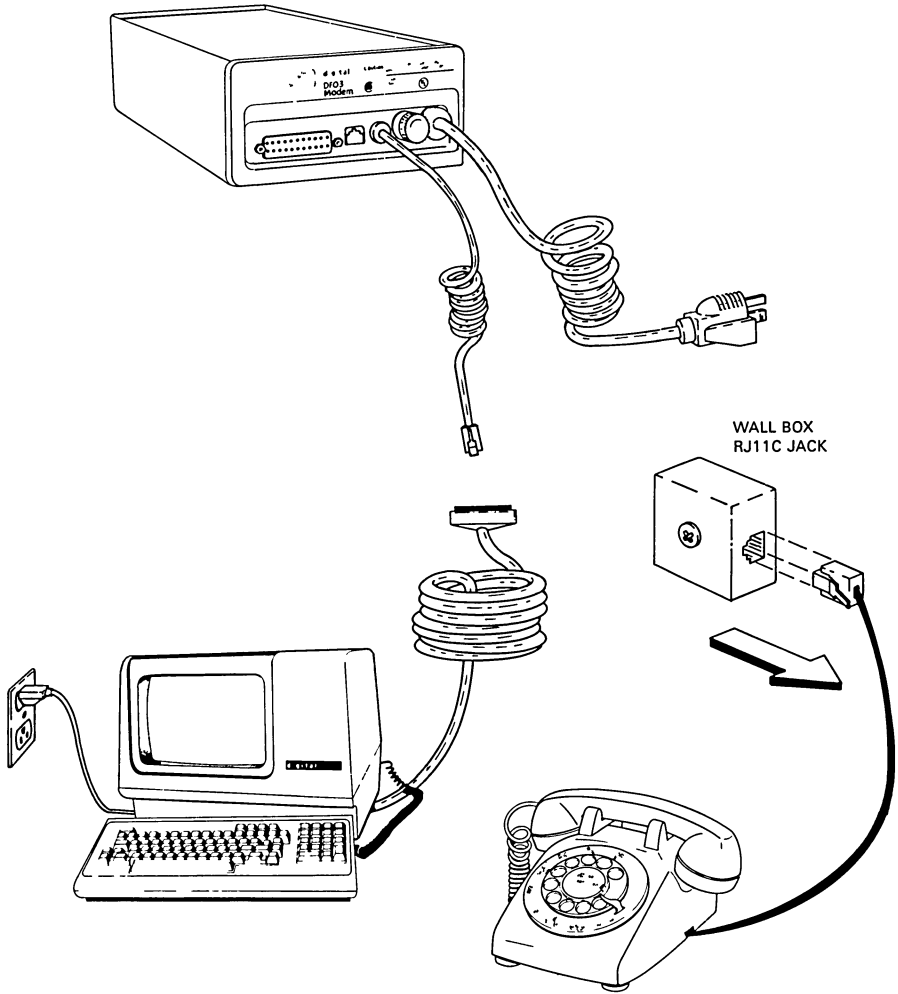
Figure 2-1 shows the rear panel connector layout of the standalone unit. To install, just follow the simple five-step procedure in Figure 2-2. Be sure to check Chapter 5 and verify that the standard factory option selections satisfy your configuration. If not satisfied, remove the modem modules to change any option.



MK-4293

Figure 2-1 Standalone DF03 Modem Rear View

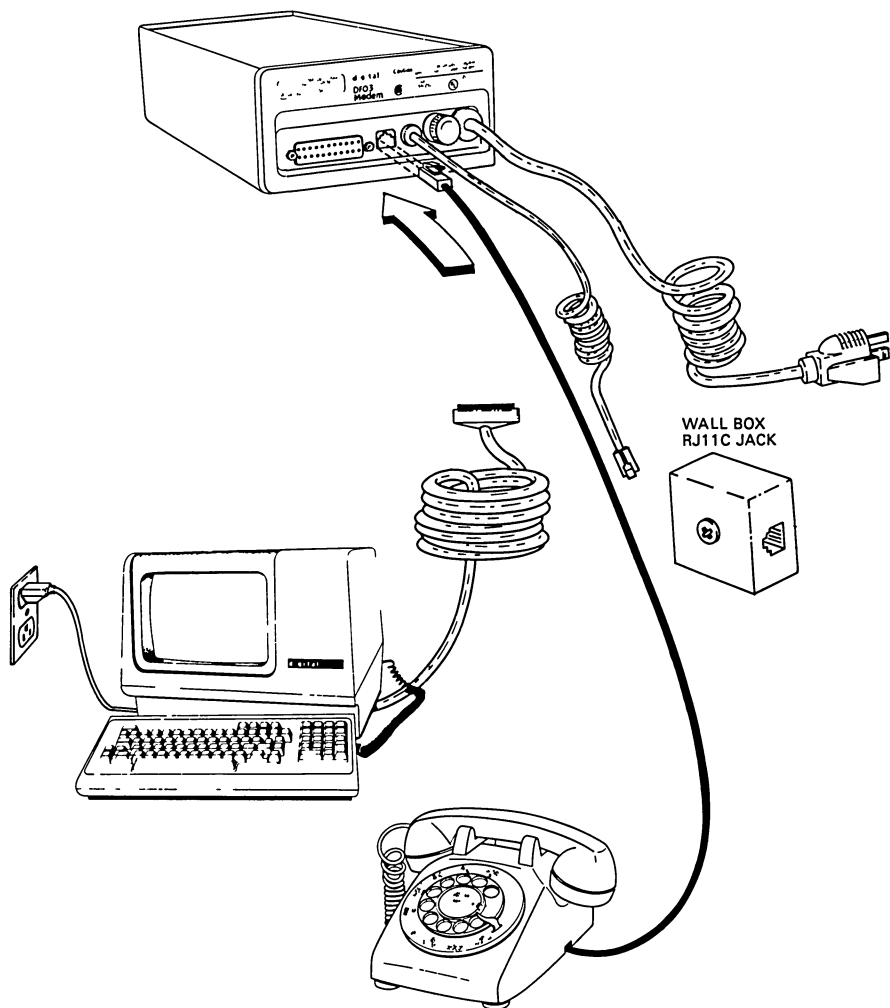
**STEP 1. UNPLUG TELEPHONE
FROM WALL BOX**



MX-3440

Figure 2-2 Standalone DF03 Modem Installation (Sheet 1 of 4)

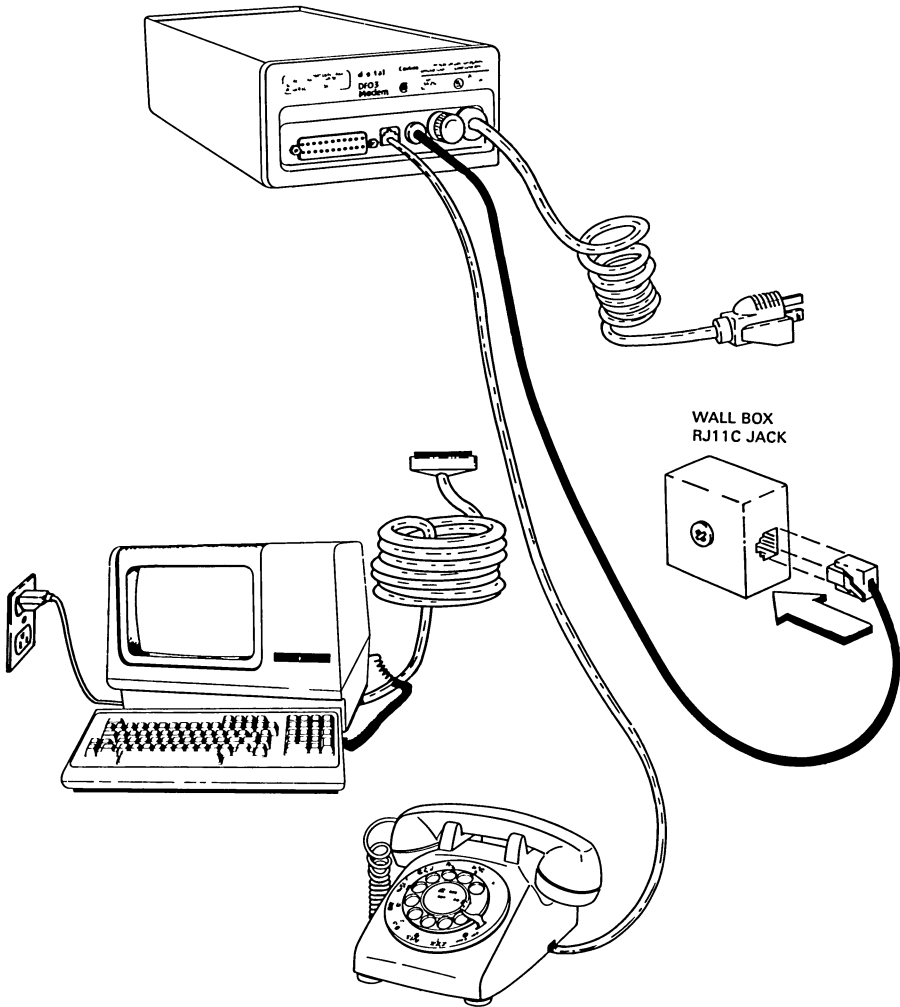
STEP 2 PLUG TELEPHONE INTO MODULAR TELEPHONE JACK ON MODEM



MK-3441

Figure 2-2 Standalone DF03 Modem Installation (Sheet 2 of 4)

STEP 3. PLUG MODEM MODULAR JACK INTO WALL BOX

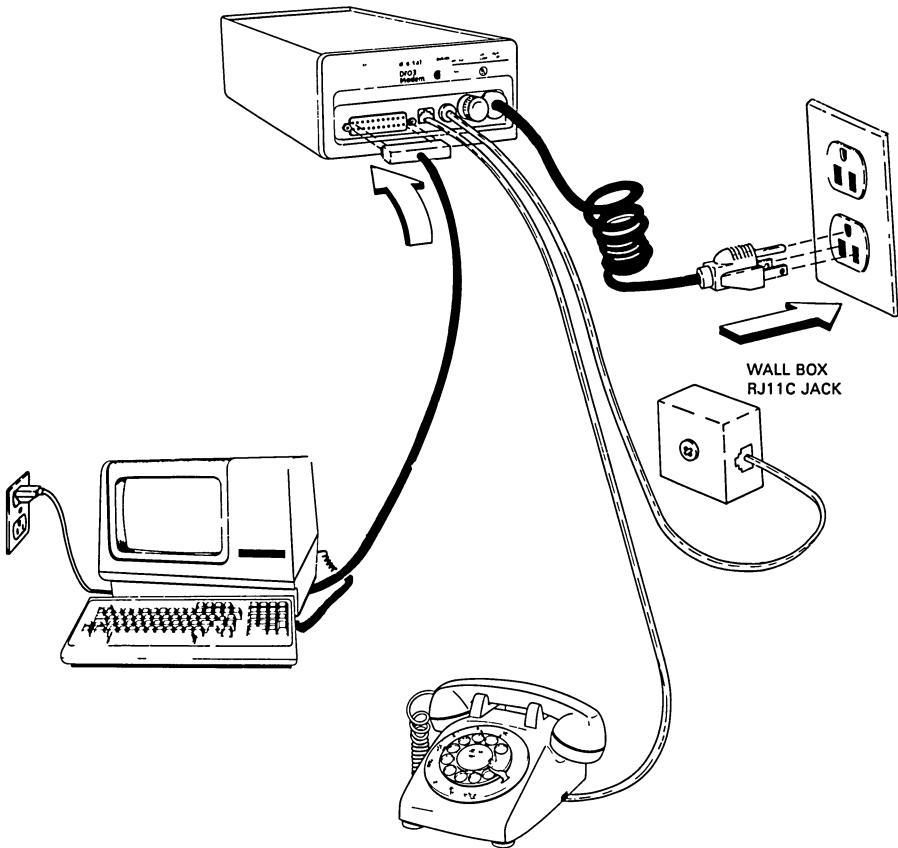


MK-3442

Figure 2-2 Standalone DF03 Modem Installation (Sheet 3 of 4)

STEP 4. PLUG TERMINAL CABLE INTO MODEM EIA CONNECTOR.

STEP 5. PLUG MODEM A C CORD INTO WALL OUTLET.



MX-3443

Figure 2-2 Standalone DF03 Modem Installation (Sheet 4 of 4)

2.5.2 Rack Mount DF100-RM Installation

Figure 2-3 is a rear view of the rack mount connector panel. EIA connections are made to J1 through J12 for modem lines one through 12 respectively. Installation requires selecting a suitable rack location within cabling distances of the data terminal equipment and the RJ21X telephone service.

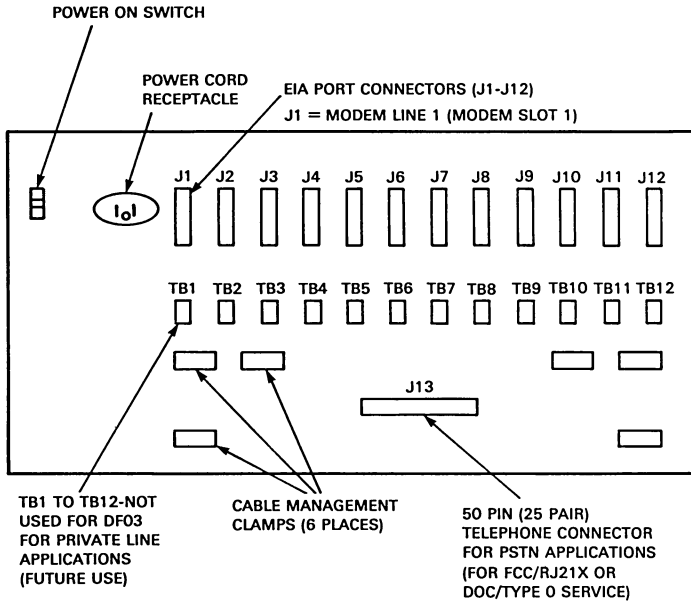


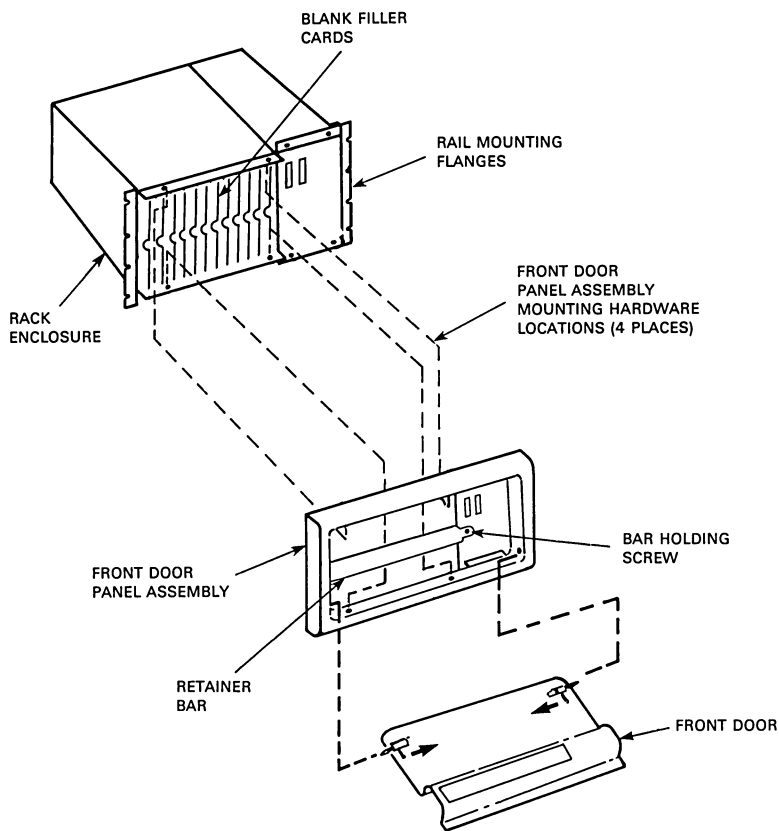
Figure 2-3 DF100-RM Rack Modem Assembly Rear View

NOTE

The location of the RJ21X service is very important. When this service is being installed, make sure it is within standard cable distance, typically 5.2 m (15 ft) from the DF100-RM. In most installations, the RJ21X service is installed in the cabinet that houses the DF100-RM enclosure.

Once the location is selected, follow the procedure below to mount the rack assembly. Refer to Figure 2-4.

1. Remove the hinged front door by opening the door (pull at the top) and releasing the two bottom spring latches (pull handles toward the center).



MK-4461

Figure 2-4 DF100-RM Enclosure Installation Diagram

2. Remove the front door panel assembly from the DF100-RM rack enclosure by removing four screws (two on the top flange and two on the bottom flange). Refer to Figure 2-4.
3. Remove all blank filler cards from the rack enclosure (Figure 2-5). Save these filler cards – DO NOT throw them away.
4. Locate the proper placement in the computer cabinet for the rack enclosure and mount it to the multiple position, vertical rail assembly of the cabinet. Standard rack mounting procedures must be observed. Be sure to leave about 3.18 cm (1.25 in) clearance between the enclosure and other equipment for reassembly of the front door panel. The mounting hardware included is eight clip nuts and eight 10-32 $\times$ 1/2 screws.

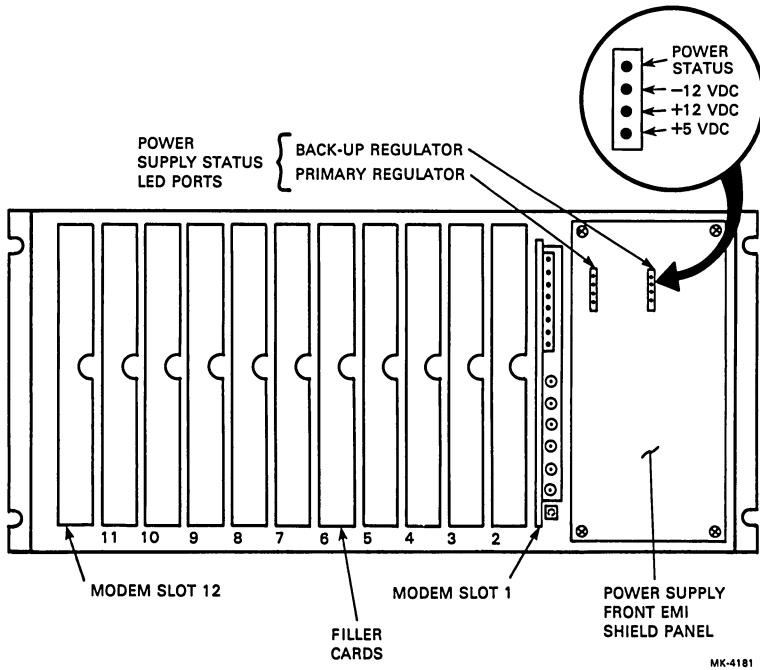
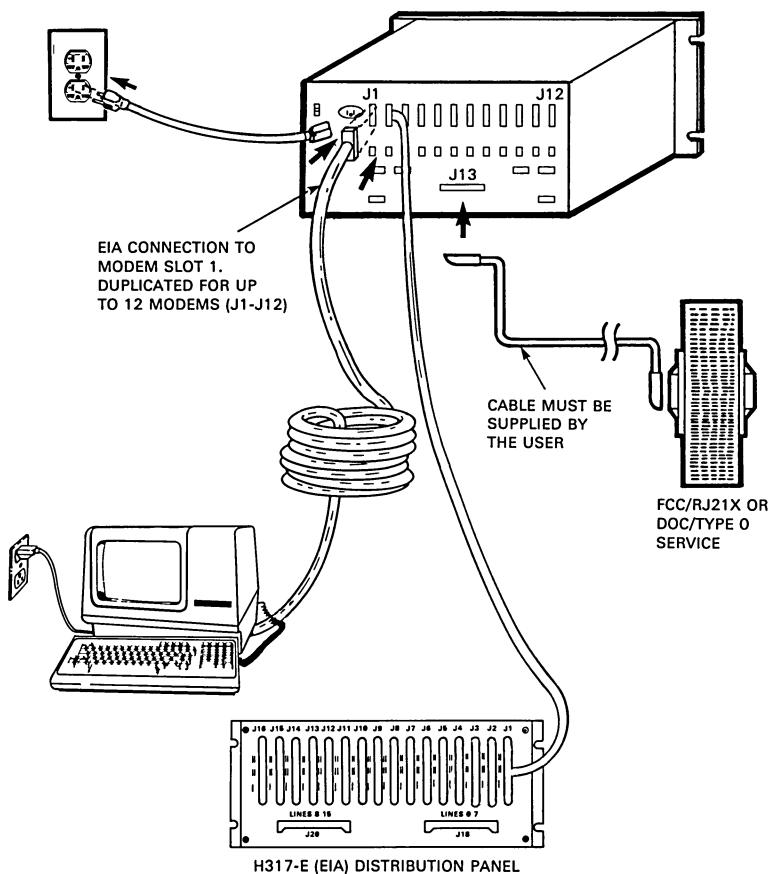


Figure 2-5 DF100-RM Rack Modem Assembly Front View

5. Reinstall the front door panel assembly that was removed in Step 2.
6. Plug the power cord into the rear panel power connector (Figure 2-6) and connect the three-pronged ac plug to an electrical outlet.
7. Install the interconnecting (B25A type) cable between J13 of the DF100-RM enclosure and the RJ21X service. Generally this cable is provided by the telephone company. If not, it must be ordered separately. Pin number/modem slot assignments for the J13 connection are detailed in Table D-1.
8. Once the telephone cable is connected, apply power to the rack assembly and observe that all the power supply status LEDs are ON (see Figure 2-5).
9. This completes the rack enclosure installation. The rack modem modules are installed next. Refer to Section 2.5.3.



MK-4460

Figure 2-6 DF100-RM Rack Modem Assembly Cabling

2.5.3 DF03-RA/RC Modem Module Installation

To install rack mount modem modules, follow the procedure below.

1. Verify that each modem module is correctly configured for the desired options (see Chapter 5). Factory selections are compatible with most data communications equipment.
2. If the modem modules are equipped with the auto call feature, be sure that the auto call module is correctly seated in its “piggyback” location on the modem module and that the interconnecting cable between the two is firmly mated at each end.

3. If the front door was removed earlier, during the DF100-RM installation, go to Step 4. Remove the hinged front door by opening the door (pull at the top) and releasing the two bottom spring latches (pull handles toward the center). The front door must be removed to either remove or insert modules (see Figure 2-4).
4. Remove the module retainer bar from front of the card cage area by unscrewing the holding screw on the right side (see Figure 2-4). Remove the other end of the bar from its retaining slot.

NOTE

If the blank filler cards were removed earlier, during the installation of the rack enclosure, go to Step 5. Before installing a modem module into its assigned slot, the filler card must be removed and saved. If ever a modem module is permanently removed, a filler card must be inserted in its place.

5. Insert and firmly seat each modem module in the rack enclosure assembly beginning with slot one (closest to the power supply). Be sure that components are facing the power supply (see Figure 2-5).
6. After installing all modules, be sure to correctly log module characteristics of each modem on the identification label located on the inside surface of the front door (see Figure 2-7). All slots must be filled with either modem modules or filler cards.
7. Connect the EIA cables for each modem line being used to the appropriate modem line jack J1 through J12. Refer to Figure 2-6.

NOTE

No connections are required to connectors TB1 through TB12. These are for future expansion.

8. Perform the test procedures in Chapter 4 that apply to your modem configuration.

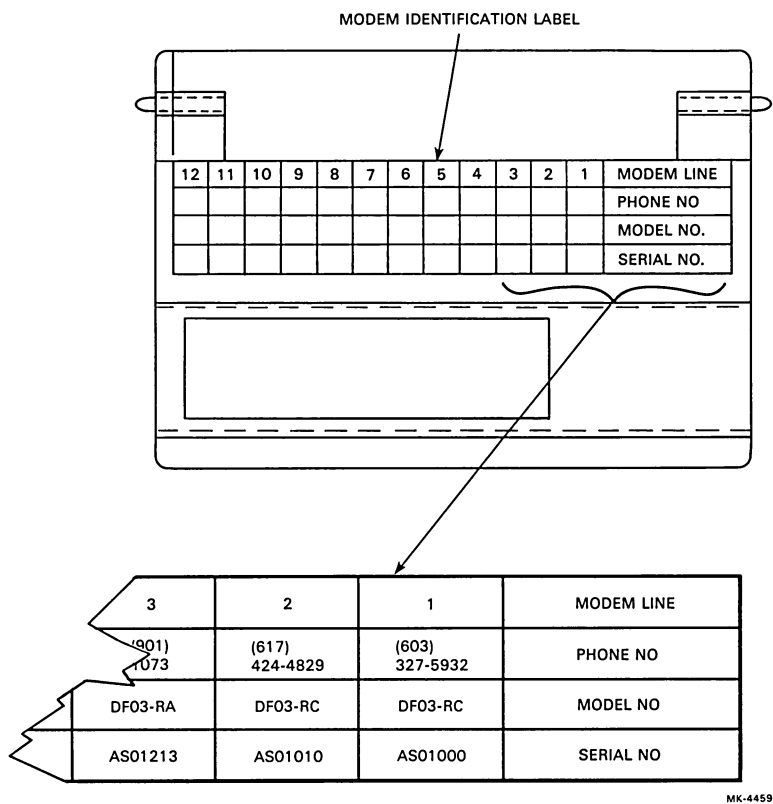


Figure 2-7 Rack Modem Identification Label

BLANK

CHAPTER 3 OPERATION

3.1 GENERAL

This chapter includes the operational description for both the standalone and rack mount DF03 modem. Although the operation of the controls and indicators are the same, unless otherwise noted, their locations on the units are different (see Figures 3-1 and 3-2 for comparison). Some LED and pushbutton switch abbreviations are different from the standalone modem and the rack mount modem. In this chapter, the abbreviations that are different for the rack mount modem are shown in parenthesis.

NOTE

Digital Equipment Corporation does not recommend that the DF03 modem be connected to a key telephone system. Since the DF03 does not provide “A-A1 lead control” to the associated telephone line card on the key telephone service unit (KSU), the telephone line card may inadvertently place the phone line on “HOLD”.

In the event that the DF03 modem is connected to a key telephone system, the “HOLD” condition may be avoided by leaving the telephone handset off hook for the duration of the data call. The handset may be replaced once the telephone data call is finished.

A permanent solution to the “HOLD” condition is available and requires the installation of special equipment. Contact your telephone equipment supplier for more information.

3.2 CONTROLS AND INDICATORS

The standalone DF03 modem contains five Light-Emitting Diodes (LEDs) and six pushbuttons, while the rack mount DF03 modem modules have eight LEDs

and six pushbuttons. Figure 3-1 illustrates the standalone configuration and Figure 3-2 shows the rack mount layout. Table 3-1 provides a description of each function.

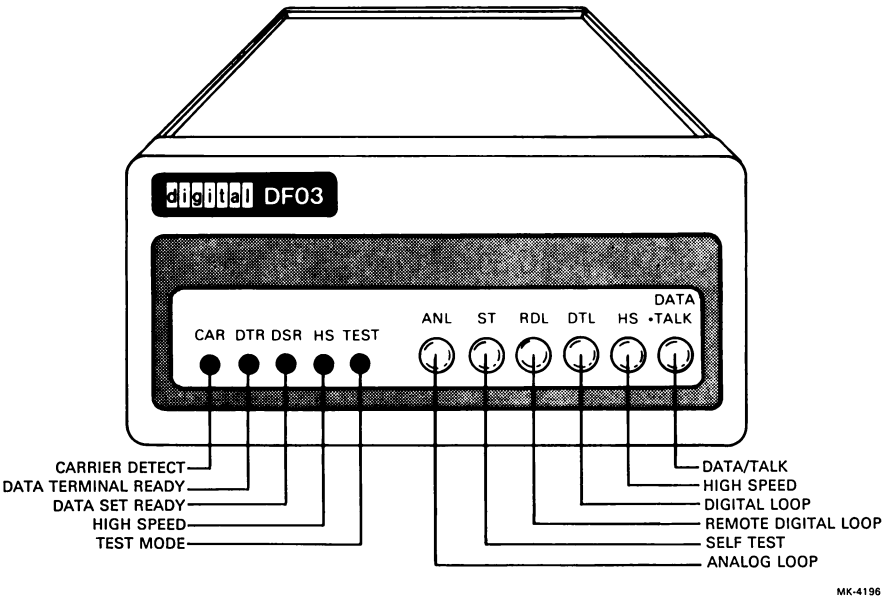


Figure 3-1 Standalone DF03 Modem Controls and Indicators

3.3 USING THE DF03 WITHOUT ACU

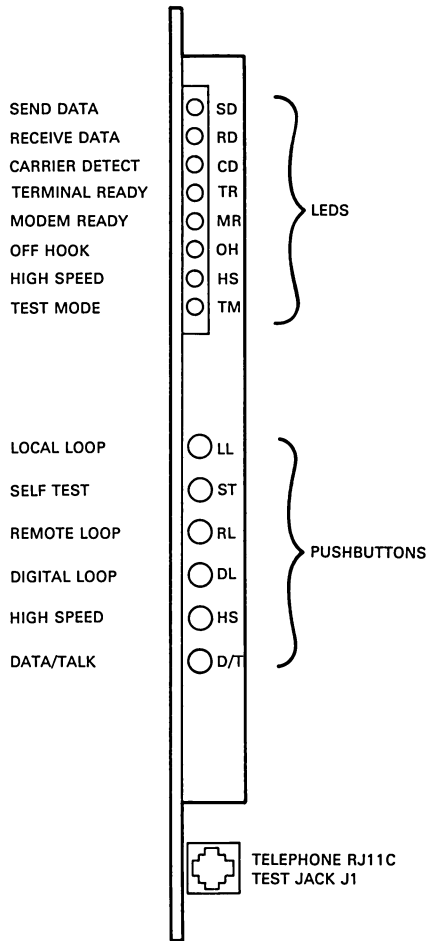
The DF03-AA standalone unit operates in one of three standard modes listed below; while the rack mount DF03-RA modem, without auto call, operates in only one mode: automatic answer. However, for maintenance purposes, the rack mount DF03-RA modem operates in the other two modes using a standard telephone set with RJ11C plug connected to the test jack J1 on the rack mount DF03 modem module. The three standard modes are:

- Manual originate mode
- Manual answer mode
- Automatic answer mode

3.3.1 Manual Originate Mode

To manually originate a call with a DF03-AA or DF03-RA with maintenance telephone, perform the following.

1. Set the ANL (LL), ST, RDL (RL), and DTL (DL) pushbuttons to the OUT position.



MK-4180

Figure 3-2 Rack Mount DF03 Modem Controls and Indicators

2. Verify that the CAR (CD) LED is OFF and that the DTR LED is ON. DTR (TR) is asserted from an on-line, powered-up terminal or system.
3. Set the HS pushbutton for the desired speed.

IN – high-speed mode (1200 b/s)
OUT – low-speed mode (0 to 300 b/s)
4. Set the DATA/TALK (D/T) pushbutton to the TALK (IN) position.

5. Lift the telephone handset and listen for a dial tone.
6. Dial the location (phone) number.

NOTE

If the call is answered manually, ask the station attendant to prepare the modem at that location for data reception by placing the DATA/TALK (D/T) pushbutton to the DATA (OUT) position.

7. When the answer tone is heard, set the originate modem DATA/TALK (D/T) pushbutton to the DATA (OUT) position.
8. Hang up the telephone handset.
9. Verify that the DSR (MR) and CAR (CD) LEDs are ON.
10. Verify that the HS LED is ON if the modem is in the high-speed mode.

3.3.2 Manual Answer Mode

To manually answer the phone when the DF03-AA is configured into your system, or a DF03-RA with maintenance telephone, perform the following procedure.

1. Verify that the DTR (TR) LED is ON and that the DATA/TALK (D/T) pushbutton is in the TALK (IN) position. All other pushbuttons are in the OUT position. DTR (TR) is asserted from an on-line, powered-up terminal or system.
2. When the telephone rings, answer it and listen.
3. When the call originator asks you to prepare for data reception, first verify that both modems are set to the same speed, then place the DATA/TALK (D/T) pushbutton in the DATA (OUT) position and hang up the telephone handset.
4. Verify that the mode changes from TALK to DATA by ensuring that the DSR (MR) and CAR (CD) LEDs come ON. If the data is transmitted at 1200 b/s, the HS LED should also be ON. Once these two LEDs are ON (three in the case of a high-speed transmission), the modem is considered "ON-LINE" and data is transmitted and received.

Table 3-1 Modem Controls and Indicators

Item	Function
Carrier Detect LED	When ON, this LED indicates that an audio carrier from a remote modem is present.
Data Terminal Ready LED	When ON, this LED indicates that the data terminal equipment is ready to send or receive data.
Data Set Ready LED (Modem Ready for Rack Modem)	When ON, this LED indicates that the data set is in the data mode.
High-Speed LED	When ON, this LED indicates that the modem is operating in the high-speed mode (1200 bits per second).
Test Mode LED	When ON, this LED indicates that the modem is in the test mode.
Off-Hook LED	When ON, this LED indicates an Off-Hook condition (rack modem only).
Receive Data LED	When ON, this LED indicates that the modem is receiving data (rack modem only).
Send Data LED	When ON, this LED indicates that the modem is transmitting data (rack modem only).
Power Regulator LEDs	When ON, this LED indicates that power to the regulator board is normal.
Power Status	
–12 Vdc	When these LEDs are ON, they indicate that power supply outputs are normal.
+12 Vdc	
+5 Vdc	
Analog Loop Pushbutton (Local Loop Pushbutton Rack Modem)	When pressed to the IN position, the modem is placed in an analog loop test mode of operation.

Table 3-1 Modem Controls and Indicators (Cont)

Item	Function
Self-Test Pushbutton	When pressed to the IN position, the modem is placed in a self-test mode of operation (standalone). Local Loop (LL) performs the same function on the rack mount DF03.
Remote Digital Loop Pushbutton	When pressed to the IN position, the remote station connected to the modem is placed in digital loopback mode (effective only in high-speed).
Digital Loop Pushbutton	When pressed to the IN position, the modem is conditioned for digital loop test, enabling testing from a remote location.
High-Speed Pushbutton	When pressed to the IN position, the modem is conditioned to operate in the high-speed mode (originates at 1200 b/s).
	When the HS pushbutton is in the OUT position, the modem is conditioned to operate in the low-speed mode (originates at a rate of 0 to 300 b/s).
DATA/TALK Pushbutton	When pressed to the IN position, voice communications can take place via the telephone set.
	When the DATA/TALK pushbutton is in the OUT position, serial binary data can be transmitted and received by the modem.

3.3.3 Automatic Answer Mode

The automatic mode of operation is just as the title implies. The DATA/TALK (D/T) pushbutton must be in the DATA (OUT) position to enable the automatic answer function. When an automatic answer modem receives a call, it automatically answers and establishes communications. The speed of the receiving modem is automatically set to the same speed as the originating modem.

3.4 AUTO CALL OPTION OVERVIEW

The auto call option for the DF03 Modem utilizes the standard modem EIA interface port to monitor special ASCII control characters that initiate and control the pulse code dialing sequence. The modem monitors the EIA interface for

these characters only when Data Terminal Ready (DTR) is asserted and there is no call established. These special control characters are defined in Table 3-2, and the associated response characters are described in Table 3-3.

Table 3-2 Control Characters

Control Character	Function
CTRL/A	Aborts a call until the ACU transfers control to the modem when the “A” response is sent.
CTRL/B	Initiates the call and prepares the Automatic Call Unit (ACU) for numeric inputs.
CTRL/C	When preceded by a CTRL/B, initiates redialing of the telephone number previously entered.
<	Transfers the telephone line to the modem after a telephone number was dialed by the ACU without looking for an answer tone (not normally used).
=	Access pause – holds dialing for an intermediate dial tone. Whenever access pause is used in terminal dialing, it must be entered within two seconds of the preceding character, otherwise a timer resets and the access pause is ignored.

Table 3-3 Response Characters

Response Character	Definition
A	The telephone line is transferred to the modem.
B	The communications link is not established. Either no dial tone was achieved within three seconds or no answer tone was obtained from the remote location within 27 or 52 seconds.
G	The automatic call unit has control; however, a CTRL/B was entered two consecutive times.

The dialing sequence is issued either manually by an operator from an asynchronous terminal keyboard, or by a program control with special routines embedded in the user's program. In either case, the procedure follows a similar sequence, except that under program control it is necessary that the program properly interprets the response characters and takes the correct action(s).

The auto call function is initiated when a control "B" (CTRL/B) is entered at the terminal keyboard or when it appears as part of the user's program routine to activate auto dial.

The control "B" character is ultimately decoded in the ACU as Start of Test (STX), which is used to clear and preset the dialer logic for dialing a specified telephone number. The auto call unit will accept a telephone number up to 16 digits in length. Valid digits are numbers zero through nine and the access pause character is the equal sign (=). The pause character is used for intermediate dial tone detection. For example, in many situations it is necessary to dial a special code number before the telephone number to access an outside line. The pause character is used to wait for the second or subsequent dial tone, before continuing with the number sequence (see the example below).

Each telephone number that is entered is always stored (in a register) for redial purposes. It is cleared either by entering a new number (which is saved) or by powering down the modem. To redial the last number, the user or CPU program must issue the redial function CTRL/B followed by CTRL/C.

A typical example for initiating an auto call sequence is shown in the example below. It is not necessary to terminate the telephone number sequence with a carriage return or any other function. As soon as a valid number is detected, the call is initiated. Using a terminate function, however, does not affect the operation. The function is simply ignored.

Example:

CTRL/B 8=603 358 1212 (Input)

A (Call complete response)

NOTE

The standalone DF03-AC auto call feature does not automatically select the speed to match the terminal or CPU speed. The speed must be selected by using switches on the M7177 ACU module (see Chapter 5). The DF03-RC rack modem auto call feature does have the capability to automatically match the interface speed (see Section 5.4.2.2).

3.5 AUTO CALL ORIGINATE – USING TERMINAL CONTROL

The operation of the DF03-AC and DF03-RC in manual originate, manual answer, and auto answer; is the same as the DF03-AA. Automatic originate mode is explained below.

Automatic Originate Mode – Auto Call

To automatically originate a call using data terminal equipment, perform the following procedure.

1. Verify that the DTR (TR) LED is ON and ensure that all push-buttons (except the HS pushbutton, that is set to your specific speed mode) are in the OUT position. DTR (TR) is asserted from an on-line, powered-up terminal or system.

NOTE

Switch selections on M7177 ACU boards must correspond to selected speed. See Table 5-8.

2. Enter a control B (CTRL/B) and the phone number (being called) from the data terminal equipment.
3. If within 27 or 52 seconds (depending on the automatic call unit jumper options) after dialing, a successful communication is established, a response character “A” is received at the data terminal equipment. The CAR (CD) and DSR (MR) LEDs on the front panel of the DF03 should come ON.

NOTE

If a “B” response is received by the data terminal equipment, start the sequence again.

4. When connection is established, proceed with normal communication functions.
5. To terminate a call, the user or CPU program must take some action that will result in turning the DTR OFF. Generally, this action depends on the hardware configuration. Some of the more common methods to turn the DTR OFF are:
 - The program simply drops DTR (TR).
 - Use the “Break” or “Shift/Break” key(s) to generate a long space disconnect.
 - Switching modes between ON-LINE and local mode.
 - Placing the DATA/TALK (D/T) pushbutton to the TALK (IN) position.

Upon termination of a call by dropping DTR (TR) at the local modem, the remote modem disconnects (due to the loss of carrier).

6. Verify that the DSR (MR) and CAR (CD) LEDs go OFF and the DTR (TR) LED comes back ON.

3.6 AUTO CALL ORIGINATE – USING PROGRAM CONTROL

The programming procedures for a DF03 modem auto call routine are very straightforward. When establishing a call, DTR must be asserted and remain asserted throughout the auto call routine to function with the DF03 modem.

Most of the difficulties in DF03 auto call programming occur with the asynchronous interface I/O driver routines that normally do not allow interface status until the modem control function Carrier Detect is true. Carrier Detect cannot be asserted by the modem until the call is established. Since neither will occur, the driver must be modified or another routine must be used.

Figure 3-3 is an example of a typical programming flowchart for a DF03 auto call routine. The flowchart provides two branches where the procedures are different, depending on whether interface status is available or not.

Branch A allows a programmer the ability to obtain interface status if the I/O driver permits status when Carrier Detect is not true. If status is not available, Branch B provides an alternative procedure to establish the call.

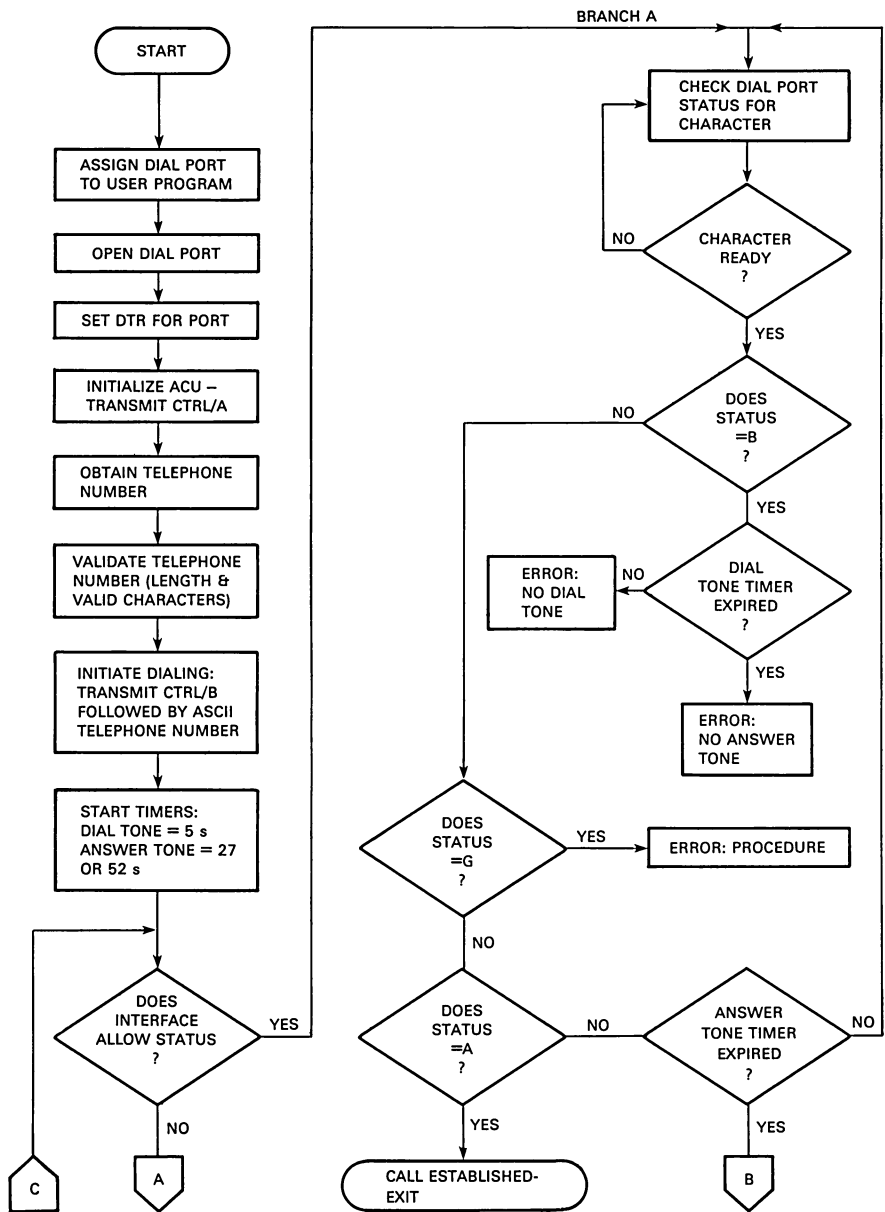
Branch B assumes that the call is established and tries to initiate a request at the remote end and respond in some way to confirm that the call is successful.

The procedure for initiating a response from the remote end is different for each unique system, especially for auto-baud links. A common or widely accepted technique is the use of the return key on the terminal keyboard.

If the connection is successful, some indication to the user should be made, such as a confirming message. Any message which is used to confirm that connection was successful, must be received before carrier is detected. If the connection is not successful, the user should also be notified in some manner (ringing the bell, for example) so that the user may continue to repeat the procedure until connection is confirmed or the answer-tone timer expires. When the timer expires, the call is unsuccessful and the procedure should be terminated by dropping DTR to the modem.

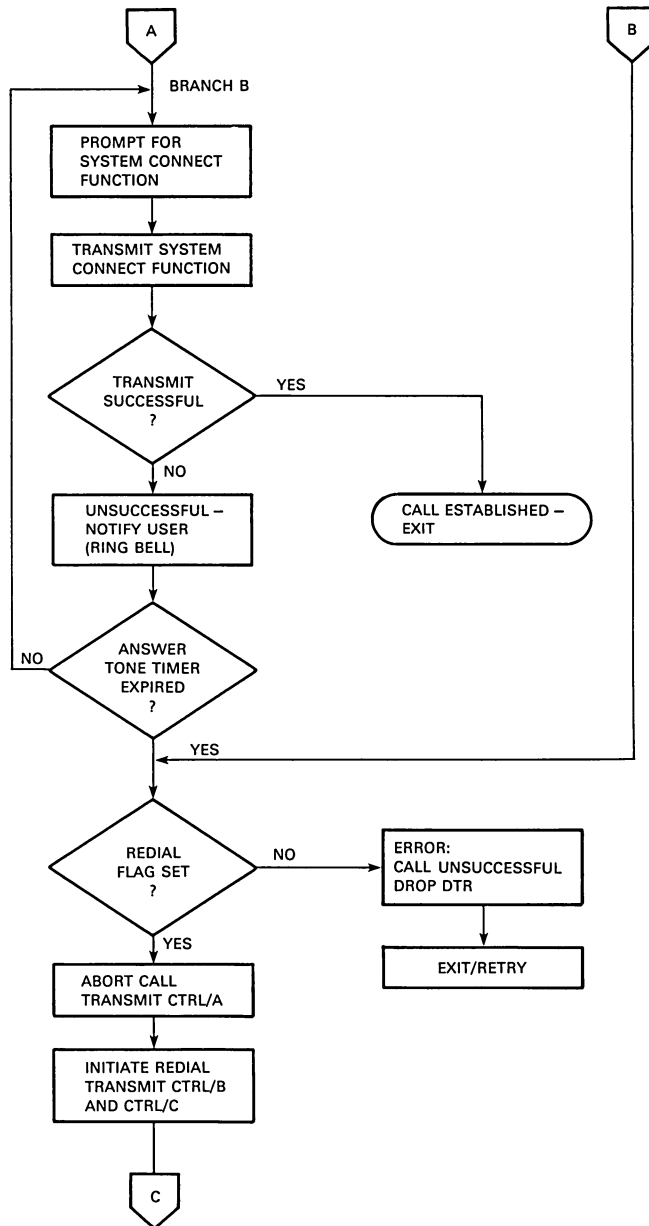
For either Branch A or Branch B, once the carrier is ON, the program can initiate data transmission. Any attempt to send data before Carrier Detect signal is true, results in lost data.

The redial feature can be used under program control, however, this feature is more suited to terminal control applications.



MK-4502

Figure 3-3 DF03 Auto Call Programming Flowchart (Sheet 1 of 2)



MK-4503

Figure 3-3 DF03 Auto Call Programming Flowchart (Sheet 2 of 2)

CHAPTER 4

TEST PROCEDURES

4.1 GENERAL

This chapter provides modem testing procedures to help isolate data communications problems on either the standalone or rack mount DF03 modem. All test functions include simplified diagrams representing the test features. In test features where a terminal is used, a computer system (interface) could be substituted. These tests are valid for both asynchronous and synchronous operation, except for the remote digital loopback test (see Section 4.4.3).

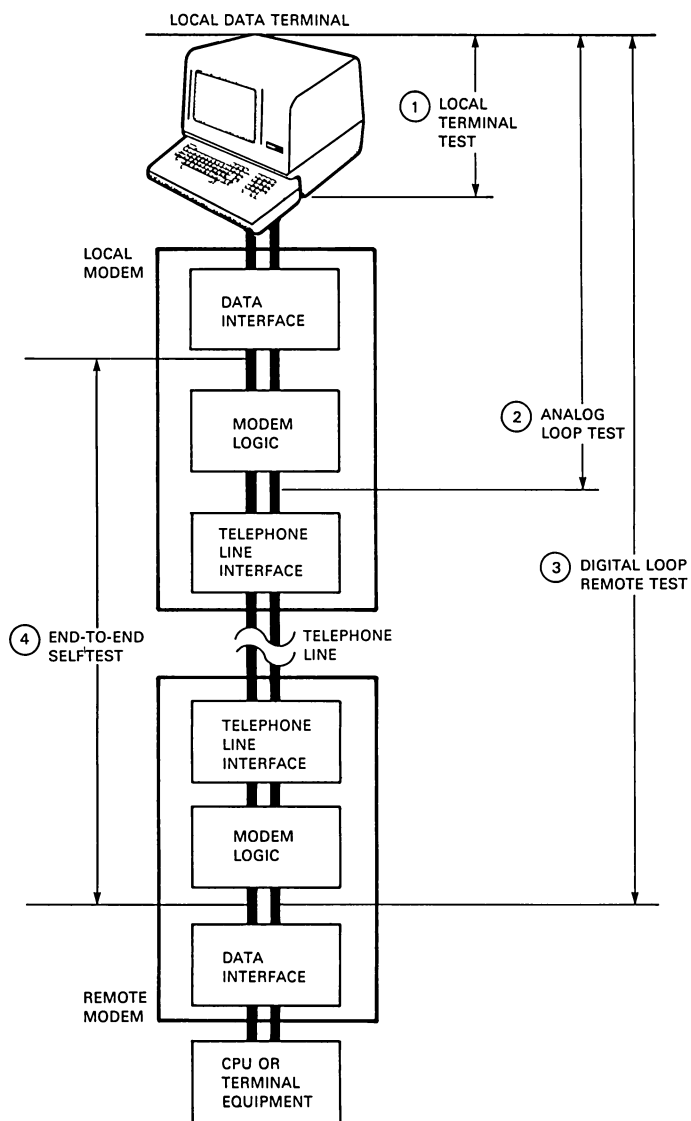
Some of the following tests use the manual originate mode to execute the test. These tests are basically for the standalone unit. However, these tests can also be executed on the rack units, provided that a telephone with an RJ11C modular connector is available to connect to the Test Jack (J1) on the rack modem module being tested.

There are three additional LEDs located on the rack mount modem module. These are:

- Off Hook (OH),
- Send Data (SD), and
- Receive Data (RD).

Some LED and pushbutton switch abbreviations on the DF100 rack mount modems are different from those on the standalone unit. In this chapter, the abbreviations in parentheses are for the DF100 rack mount DF03-RA/RC modems.

The correct procedure to test and verify a modem communications link is shown in Figure 4-1. The four modem test areas are listed below and discussed in the following text.



MK-4226

Figure 4-1 Data Path Acceptance Test Sequence

1. Test Area 1 – Local Terminal Test

Tests the local terminal.

2. Test Area 2 – Analog Loop Test

Verifies that the local modem can transmit and receive data.

3. Test Area 3 – Digital Loop Remote Test

Verifies the complete network including the remote modem.

4. Test Area 4 – End-to-End Selftest

Verifies both local and remote modem, separating transmit and receive logic.

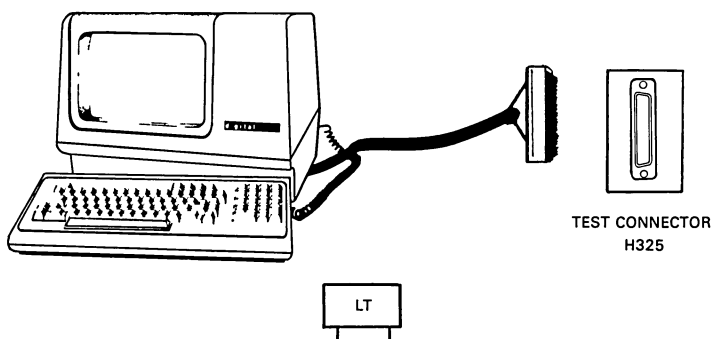
4.2 TEST AREA 1 – LOCAL TERMINAL TEST (FIGURE 4-2)

These tests determine if the terminal or computer interface is working correctly. To verify the terminal or computer interface, perform the following.

- Terminal Test
 - Set terminal to off-line local test and type test message. Verify that correct message is received.
 - Set terminal to on-line and install EIA cable loopback connector (H325) at the end of the EIA cable that attaches to the modem. Repeat test message verification.
- Computer Interface Test
 - Execute a test message with the communication interface set to internal loopback mode and verify that correct message is received.
 - Set the communication interface to normal mode and install an EIA cable loopback connector (H325) at the end of the EIA cable that attaches to the modem. Send test message and verify.

4.3 TEST AREA 2 – ANALOG LOOPBACK TEST

Test Area 2 generally has two separate tests: the analog loopback selftest and the analog loopback. Both tests verify that the modem can transmit and receive data at the local modem with no errors. Each of these tests is discussed below.

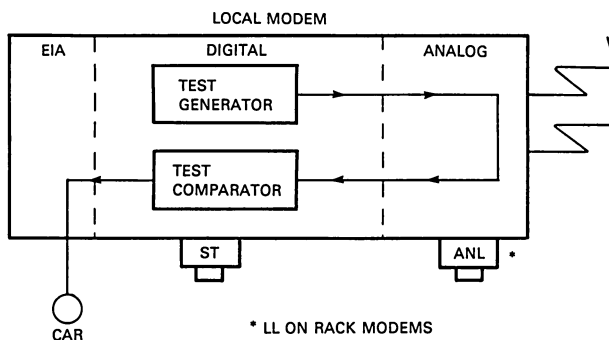


MK-3501

Figure 4-2 Local Terminal Test

4.3.1 Analog Loopback Selftest (Figure 4-3)

This test uses an internal test generator for the transmitter and a test comparator on the receiver to detect errors. If errors occur, the modem carrier LED flashes ON and OFF after the test begins. It is normal for the carrier LED to flash once or twice at the beginning of the test.



MK-3500

Figure 4-3 Analog Loopback Selftest

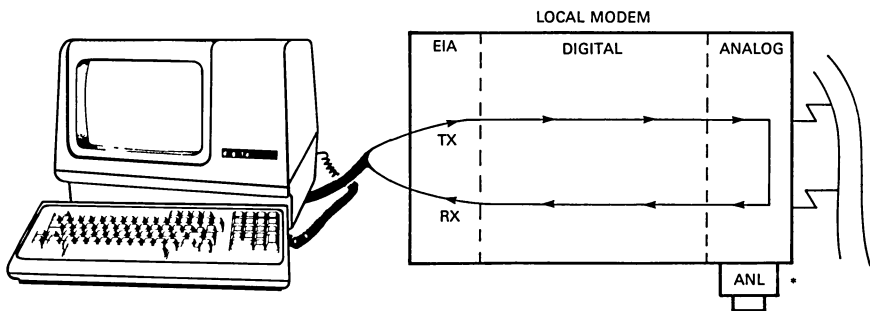
PROCEDURE:

1. Verify that the CAR (CD) and DSR (MR) LEDs are OFF.
2. Configure the following test switches.
 - a. Set the HS speed switch to the desired speed – low speed (OUT), high speed (IN).

- b. Set the ANL (LL) switch to the IN position.
 - c. Set the ST switch to the IN position.
3. Verify that the TEST (TM) LED comes ON. If high speed was selected, the HS LED will also come ON.
4. Observe that the CAR (CD) LED comes ON and stays ON. This may take up to three seconds. It may flash once or twice at the beginning. Verify that the CAR (CD) LED never flashes again or goes OFF. If it does, the DF03 modem is defective.
5. To check the other modem speed, change the position of the HS switch from its previously set position. The CAR (CD) LED again flashes at first; then it should remain ON as in Step 4.
6. To terminate, release the ANL (LL) and ST switches to the OUT position.

4.3.2 Analog Loopback Test (Figure 4-4)

This test uses a data terminal or computer interface to input the test message. To verify the data, the operator must observe that the received data is correct. This test is very useful, checking both the terminal and the modem.



* LL ON RACK MODEMS

MX-4227

Figure 4-4 Analog Loopback Test

PROCEDURE:

1. Verify that the DTR (TR) LED is ON and the CAR (CD) and DSR (MR) LEDs are OFF.

2. Configure the following test switches.
 - a. Set the HS speed switch to the desired speed – low speed (OUT), high speed (IN).
 - b. Set the ANL (LL) switch to the IN position.
3. Verify that the TEST (TM) LED comes ON. If high speed was selected, the HS LED will also come ON.
4. Observe that the CAR (CD) LED comes ON within three seconds and stays ON.
5. Type a test message on the terminal and verify that the correct data is received. Incorrect data indicates a defective modem or wrong terminal speed.
6. To terminate, set the ANL (LL) switch to the OUT position.

4.4 TEST AREA 3 – DIGITAL LOOPBACK TESTS (FIGURES 4-5 THROUGH 4-8)

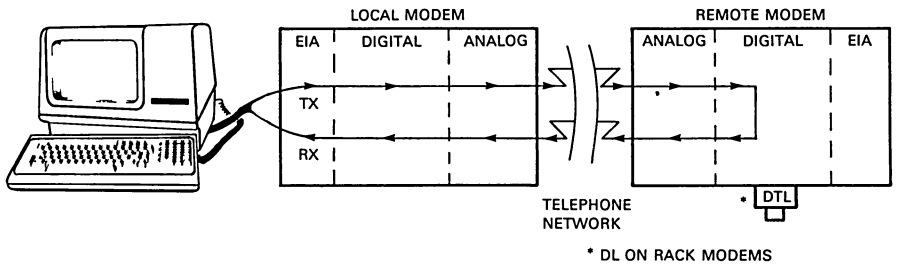
Test Area 3 has separate tests (similar to Test Area 2) except the test function is digital loopback, with either a selftest mode or terminal/computer test. The digital loopback tests allow the complete network to be checked including the remote modem logic. This test verifies the telephone line and the receive/transmit logic of the remote modem. This test does not verify any EIA level conversion at the remote modem.

The DF03 modem has four tests that are associated with digital loopback. These tests are associated with the selftest logic which uses a special switch called remote digital loopback. The following describes these various modem tests.

NOTE

The RDL (RL) function only works in the high-speed mode and allows the local modem operator to cause the remote modem to automatically switch to digital loopback without pressing the remote modem's DTL (DL) switch. No operator is needed at the remote site.

4.4.1 Digital Loopback Tests (Figure 4-5)



MK-4228

Figure 4-5 Digital Loopback

PROCEDURE:

1. Verify that the DTR (TR) LED is ON.
2. Configure the following test switches.
 - a. Set DATA/TALK (D/T) switch to TALK position (IN).
 - b. At remote DF03 modem, have someone press the DTL (DL) switch to the IN position. Set the HS speed switch to the desired speed – low speed (OUT), high speed (IN).
3. Remove telephone handset from cradle and dial the remote modem. For rack modems, use a maintenance telephone connected to J1 on the modem module.
4. When answer tone is heard, set the DATA/TALK (D/T) switch to the DATA position (OUT). Place the telephone handset back on the cradle.
5. Verify the following LEDs.
 - a. CAR (CD) is ON.
 - b. DSR (MR) is ON.
6. Type a test message on the terminal and verify that the correct data is received.

- #### 4.4.2 Digital Loopback Selftest (Figure 4-6)



MK-3504

Figure 4-6 Digital Loopback Selftest

PROCEDURE:

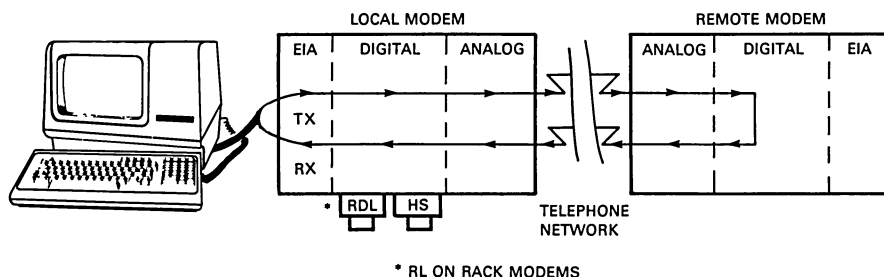
1. Verify that the DTR (TR) LED is ON.
2. Configure the following test switches.
 - a. Set DATA/TALK (D/T) switch to TALK position (IN).
 - b. Set ST switch to IN position.
 - c. At remote DF03 modem, have someone press the DTL (DL) switch to the IN position. Set the HS speed switch to the desired speed – low speed (OUT), high speed (IN).

3. Remove telephone handset from cradle and dial the remote modem. For rack modems, use a maintenance telephone connected to J1 on the modem module.
4. When answer tone is heard, set the DATA/TALK (D/T) switch to the DATA position (OUT). Place the telephone handset back on the cradle.
5. Verify that the CAR (CD) LED is ON. Observe that the CAR (CD) LED never flashes ON and OFF except at the very beginning of the test. If it does, one of the modems or the telephone network is receiving errors. Return to local analog modem testing or end-to-end self-test to verify modems before suspecting the telephone network.
6. To terminate, release the ST switch and press the DATA/TALK (D/T) switch to the IN position.
7. Return the DATA/TALK (D/T) switch to DATA position (OUT) to allow automatic answer for incoming calls.

4.4.3 Remote Digital Loopback (Figure 4-7)

NOTE

If the modems are configured for synchronous operation and the Terminal Timing slave option is selected at one of the modems (see Table 5-5 for DF03-AA/AC or Table 5-9 for DF03-RA/RC), this test cannot be performed at that end.



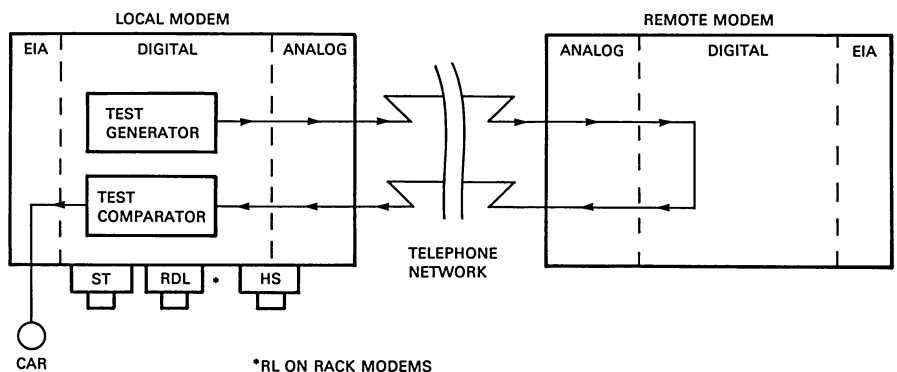
MK-4229

Figure 4-7 Remote Digital Loopback

PROCEDURE:

1. Verify that the DTR (TR) LED is ON.
2. Configure the following test switches.
 - a. Set DATA/TALK (D/T) switch to TALK position (IN).
 - b. Set HS switch to IN position.
 - c. Set RDL (RL) switch to IN position.
3. Remove telephone handset from cradle and dial remote modem. For rack modems, use a maintenance telephone connected to J1 on the modem module.
4. When answer tone is heard, set the DATA/TALK (D/T) switch to the DATA position (OUT). Place the telephone handset back on the cradle.
5. Observe that the CAR (CD), DSR (MR), HS, and TEST (TM) LEDs are all ON.
6. Type a test message on the terminal and verify that the correct data is received.
7. To terminate, press the DATA/TALK (D/T) switch to TALK position (IN).
8. If test is performed at the computer end, repeat the above procedure. The computer modem then becomes the local modem and the terminal modem is the remote. The computer end will then have to generate the test message and verify the results.
9. Return the DATA/TALK (D/T) switch to the DATA position (OUT) to allow automatic answer for incoming calls.

4.4.4 Remote Digital Loopback Selftest (Figure 4-8)



MK-3503

Figure 4-8 Remote Digital Loopback Selftest

PROCEDURE:

1. Verify that the DTR (TR) LED is ON.
2. Configure the following test switches.
 - a. Set DATA/TALK (D/T) switch to TALK position (IN).
 - b. Set HS switch to IN position.
 - c. Set RDL (RL) switch to IN position.
 - d. Set ST switch to IN position.
3. Remove telephone handset from cradle and dial remote modem. For rack modems, use a maintenance telephone connected to J1 on the modem module.
4. When answer tone is heard, set the DATA/TALK (D/T) switch to the DATA position (OUT). Place telephone handset back on the cradle.
5. Verify that the CAR (CD), HS, and TEST (TM) LEDs are all ON. Observe that the CAR (CD) LED never flashes ON and OFF except at the very beginning of the test. If it does, one of the modems or telephone networks is receiving errors. Return to local modem testing or go to end-to-end selftesting to help isolate the problem.

6. To terminate, release the ST switch and press the DATA/TALK (D/T) switch to the IN position.
7. Return the DATA/TALK (D/T) switch to DATA position (OUT) to allow automatic answer for incoming calls.

4.5 TEST AREA 4 – END-TO-END SELFTEST

Test Area 4 allows the local and remote modems to be verified over the telephone network. It separates the transmit and receive logic of both modems. This separation permits better problem isolation. A local modem may check out in the analog loopback test, but fail in the digital loopback test. With this test, if the problem is not the telephone network, the failing transmitter or receiver can be located. Refer to Figure 4-9.

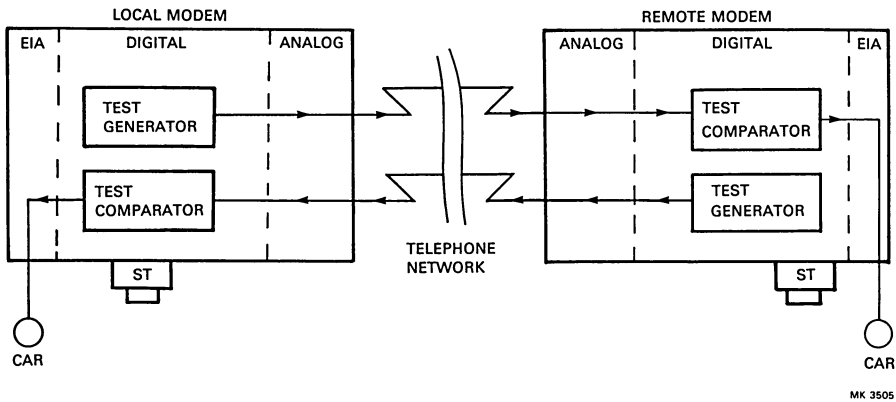


Figure 4-9 DF03 Modem End-to-End Selftest

PROCEDURE:

1. Configure the following test switches at both modems.

NOTE

This requires a second person at the remote site to set the same switches.

- a. Set the HS speed switch to the desired speed – low speed (OUT), high speed (IN).
- b. Set the ST switch to the IN position.
- c. Set DATA/TALK (D/T) switch at remote modem to the DATA position (OUT).

- d. Set DATA/TALK (D/T) switch at local modem to TALK position (IN) to allow dialing remote modem.
2. Remove telephone handset from cradle on local modem and dial the remote modem. For rack modems, use a maintenance telephone connected to J1 on the modem module.
3. When answer tone is heard, set the DATA/TALK (D/T) switch to the DATA position (OUT). Place the telephone handset back on the cradle.
4. Verify that the CAR (CD), DSR (MR), and TEST (TM) LEDs are all ON. If in high-speed mode, the HS LED is also ON. Observe that the CAR (CD) LED never flashes ON and OFF except at the very beginning. Be sure to have the remote operator verify the LEDs on the remote modem. Any flashing of the CAR (CD) LED indicates data errors and distortion. Repeat this test more than once to rule out a defective telephone line before determining which modem is defective.
5. To terminate, release the ST switch and press the DATA/TALK (D/T) switch to the IN position at both modems.
6. Return the DATA/TALK (D/T) switch to DATA position (OUT) to allow automatic answer for incoming calls.

4.6 DF03 AUTO CALL TESTING

Testing the DF03-AC and DF03-RC for auto call functions can be easily performed by doing any digital loopback test functions with the DATA/TALK switch in the DATA position (OUT), and dialing the remote modem by using the auto call message format. If the call is initiated via a terminal, when the modem receives the answer tone, a character "A" is returned to the terminal acknowledging that the call was completed.

The test message may then be sent and the received data verified. If the DF03 selftest mode is used with digital loopback, then the CAR LED must be observed.

BLANK

CHAPTER 5

MODEM OPTIONS

5.1 GENERAL

This chapter describes the many selectable options that are available on both the standalone DF03 modem and the rack mount DF03 modem. As configured at the factory (standard configuration), these modems are designed to be compatible with most commercial data communications equipment. However, these modems have selectable options to provide greater versatility. A detailed description of each option is provided in Tables 5-1 and 5-2.

To verify or change any of these options on the standalone DF03 modem, it is necessary to disassemble the unit to access the PCB modules. For the rack mounted DF03 modem, simply remove the front door and retainer bar, and pull out the modem module.

5.2 STANDALONE DF03 DISASSEMBLY

Disassembly procedures for both the DF03-AA and DF03-AC are the same; just follow the simple procedures in Figure 5-1. When removing the PCBs from the case, be careful not to damage cables or components. Also, notice that the DF03-AC contains three PCBs compared to two for the DF03-AA.

5.3 RACK MOUNT DF100-RM DISASSEMBLY

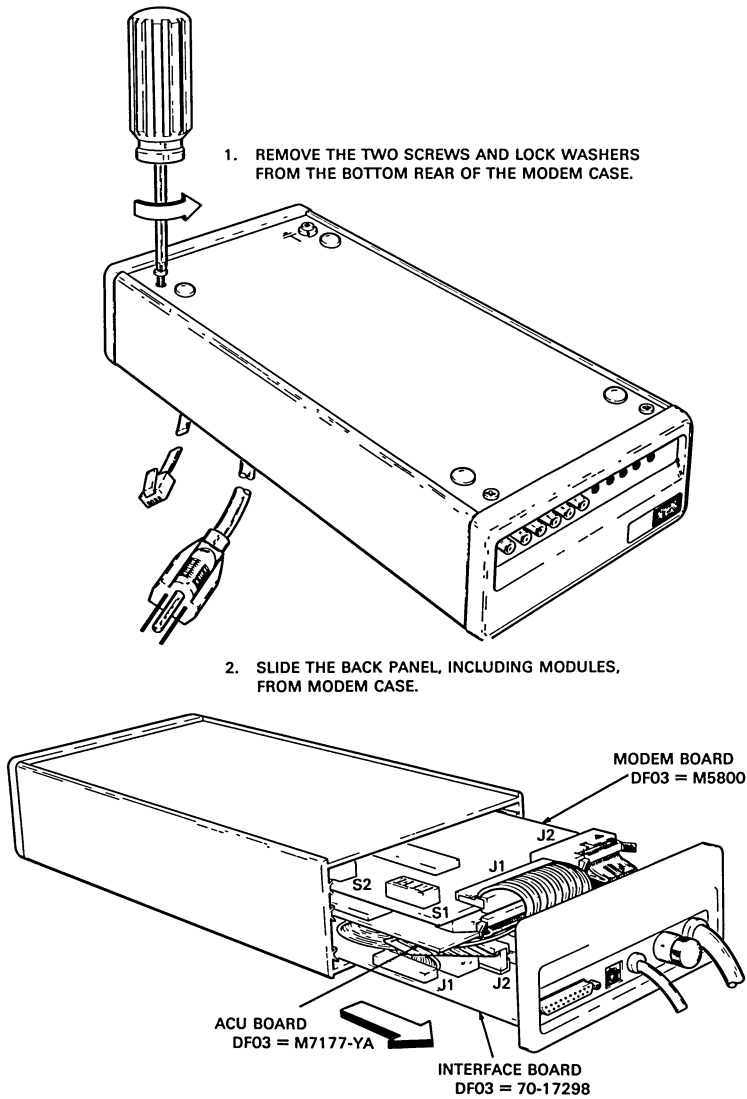
Disassembly of the rack mount DF100-RM enclosure is accomplished by removing the front door to access the modem PCBs. Remove the front door panel assembly and the power supply front EMI panel to access the power supply PCBs. To remove and replace these modules, it is not necessary to disconnect any of the system cabling. Figure 5-2 illustrates the procedure for removing the front panel and power supply EMI panel.

5.4 SELECTING SWITCHPACK/JUMPER OPTIONS

Each module in both the standalone and rack mount DF03 modem include configuration options, selected by either jumpers or switchpacks.

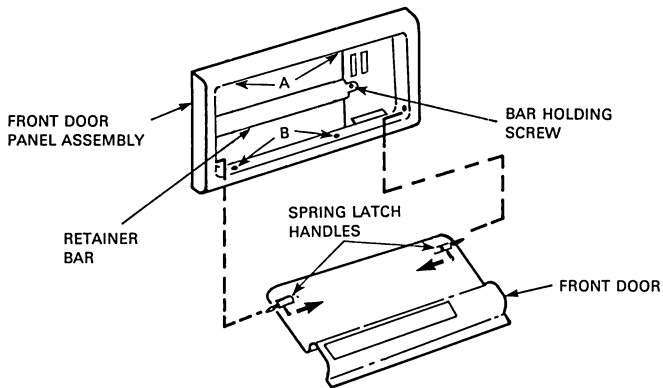
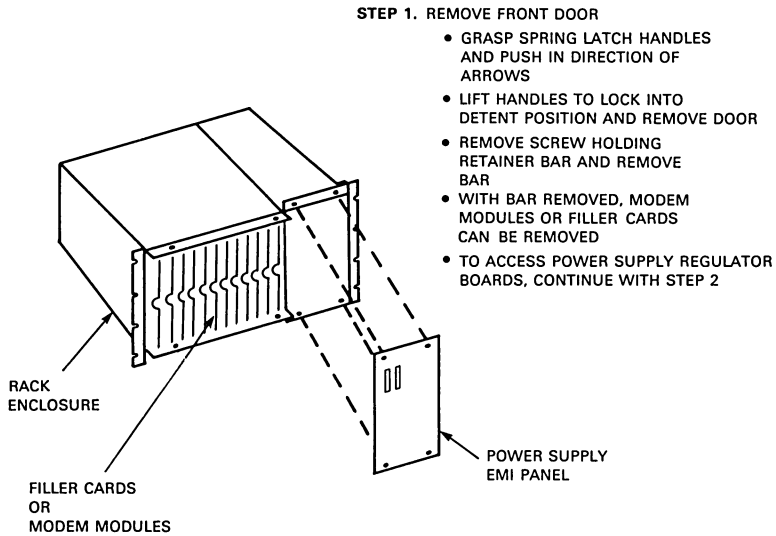
On early versions of the standalone DF03, options were selected by jumpers. On later versions (beginning with serial # ASA 3500 for DF03-AA and ASA 6400 for DF03-AC), switchpacks are used to select options.

TO ACCESS STANDALONE DF03 MODULES, PERFORM THE FOLLOWING:



MK-4220

Figure 5-1 Standalone DF03 Disassembly



STEP 2. REMOVE FRONT DOOR PANEL ASSEMBLY

- REMOVE FOUR MOUNTING SCREWS [TWO ON TOP FLANGE (A) AND TWO ON BOTTOM FLANGE (B)]

STEP 3. REMOVE POWER SUPPLY EMI PANEL

- REMOVE FOUR MOUNTING SCREWS IN EACH CORNER OF THE PANEL

MK-4182

Figure 5-2 Rack Mount DF100-RM Disassembly

Table 5-1 Detailed Modem Options Descriptions

Option Function	Option Description	Factory Configuration
Interface Terminal Timing	When enabled, it allows external transmit timing (EIA Pin 24) to control internal modem clock. In slave mode, the receiver clock controls the transmit clock.	Disabled
Receiver Timing	When enabled, it allows the receiver timing signal on EIA Pin 17. This option must be enabled for synchronous operation.	Disabled*
Transmit Timing	When enabled, it allows the transmit timing signal on EIA Pin 15. This option must be enabled for synchronous operation.	Disabled*
Mode Select	Selects asynchronous or synchronous operation. This option must be set to sync for synchronous operation.	Async*
Character Length	Selects data character length of nine or ten bits.	10 Bits
Receiver Responds to Remove Digital Loopback	When disabled, the receiver logic does not allow remote digital loopback testing.	Enabled
Loss of Carrier Disconnect	When enabled, the modem terminates the call if carrier is lost for more than 350 ms.	Enable
Send Space Disconnect	When enabled, the modem transmits three seconds of spacing signal at the end of a call. Used with long space disconnect option. This option must be disabled for synchronous operation.	Enabled*

* These options must be set opposite to the standard factory settings for synchronous 1200 b/s operation.

Table 5-1 Detailed Modem Options Descriptions (Cont)

Option Function	Option Description	Factory Configuration
Long Space Disconnect	When enabled, the modem terminates a call upon receiving about 1.6 seconds of spacing signal. This option must be disabled for synchronous operation.	Enabled*
Auto Answer	When enabled, the auto answer circuitry allows the modem to respond to ring indicate.	Enabled
Terminal Timing	Allows for three possible transmitter timing sources. • Internal (Enable) – Transmit clock from master oscillator. • External (Disable) – Transmit clock from external oscillator source through EIA Pin 24. • Slave – Transmit clock is derived from receive clock.	Enabled
Speed Mode	When in dual mode, both low- and high-speed data circuits work. In high only, the 1200 b/s speed is operative.	Dual
Interface Speed Selection	When enabled, the terminal selects modem speed by controlling EIA Pin 23. When Pin 23 is active, 1200 b/s operation is selected and when inactive, 300 b/s speed is selected.	Disabled

* These options must be set opposite to the standard factory settings for synchronous 1200 b/s operation.

Table 5-1 Detailed Modem Options Descriptions (Cont)

Option Function	Option Description	Factory Configuration
Interface Speed Indication	When enabled, the modem provides an indication of modem speed to the terminal on EIA Pin 12. When Pin 12 is active, 1200 b/s operation is selected and when inactive, 300 b/s speed is selected.	Enabled
Interface Speed Pin Indication	In normal, the speed indicator is on EIA Pin 12. In alternate, the speed indicator is on EIA Pin 11. When disabled, there is no interface speed indication.	Normal
Interface RDL Control	When enabled, a positive voltage on EIA Pin 21 selects RDL mode.	Disabled
Interface ANL Control	When enabled, a positive voltage on EIA Pin 18 selects modem analog loopback. When disabled, it opens Pin 18 to modem.	Disabled
Interface Ring Indication	When enabled, it allows ring indicate signal out to EIA Pin 22. When disabled, it prevents ring indicate from going to the interface.	Enabled
Interface Test Mode Indicate	When enabled, a positive voltage appears on EIA Pin 25 as the modem enters any test mode.	Disabled
DSR Indication in ANL	When enabled, data set ready comes ON in analog loopback test mode.	Enabled
CTS, CAR Detect Interface Indication	When common, the CTS lead is forced OFF and the CAR detect lead goes OFF. When separate, both signals are independent of each other.	Separate

Table 5-1 Detailed Modem Options Descriptions (Cont)

Option Function	Option Description	Factory Configuration
CAR Detect Interface Indication	When normal, the carrier detect (EIA Pin 8) follows the modem carrier signal. When forced, it makes EIA Pin 8 HIGH all the time.	Normal
DSR Interface Indication	When normal, the data set ready (EIA Pin 6) follows the modem signal. When forced, makes EIA Pin 6 HIGH all the time.	Normal
CTS Interface Indication	When normal, it is clear to send (EIA Pin 5) follows the modem signal. When forced, it makes EIA Pin 5 HIGH all the time.	Normal
Grounds	Provides the ability to separate the signal ground from the chassis ground.	Common
DF03-AA/RA to DF03-AC/RC Configuration	Provides ability to utilize standard modem boards with the flexibility to add optional auto call module for automatic originate configurations using the serial async auto call feature.	Option Dependent
Transmit Level Normal/Programmed	Provides rack modems with the ability to be used in permissive RJ45 telephone service in future applications and must always be set to normal.	Normal

Table 5-2 Detailed ACU (M7177) Option Descriptions

Option Function	Option Description	Factory Configuration
Character Length	Select data character length of seven or eight bits	8 bits
Stop Bit Select	Selects the number of stop bits for data code - 1 or 2	1 stop bit
Parity Select & Type	Selects whether parity is enabled or disabled and the correct type – either odd or even	Inhibit/ Odd
Communication Bit Rate	Selects the correct data rate speed (110, 300, 1200 b/s) so that the auto call logic can decode ASCII control characters and telephone numbers from the terminal or the CPU.	1200 b/s - DF03-AC auto select- able DF03-RC
NOTE: This speed must match the terminal or CPU interface speed. For DF03-RC, auto selectable feature selects speed automatically.		
Dialer Speed	Allows the ACU to dial the telephone number at either 10 or 20 pulses/sec. Some telephone systems do not accept 20 pulses.	10 pulses
Answer Tone Abort Timer	Allows the ACU to disconnect the the line if the dial tone is not detected within either 27 sec. or 52 sec.	27 sec.

Table 5-2 Detailed ACU (M7177) Option Descriptions (Cont)

Option Function	Option Description	Factory Configuration
Local Copy	When enabled, it allows the transmitted data to echo back on the receive data line until the modem takes control of the telephone line (for example, off-hook). This should only be used in applications where transmission and reception does not occur at the same time, otherwise echoed data is mixed with received data.	Disabled

Modules in both the standalone and rack mount units may be equipped with any of the three switchpack types shown in Figure 5-3.

NOTE

Placing any switch to the side labeled ON causes the switch to be enabled, which is the same as a jumper being installed on early DF03 standalone units. Placing any switch to the opposite side (labeled OFF) disables the switch, which is the same as a jumper being removed on earlier units.

For convenience, the following illustrations show switchpack configurations only. On the earlier standalone DF03 modems, jumpers replace switches in the same location. All further reference is made to switchpacks.

5.4.1 Standalone DF03 Options

5.4.1.1 Interface Board (70-17298) – The Interface Board provides two switchpacks to select certain options (see Figure 5-4). These options and the switch selections for each, are listed in Tables 5-3 and 5-4. This module also includes one jumper option that performs the following function.

W1-Installed = Selects common ground.

W1-Removed = Separates signal ground from chassis ground.

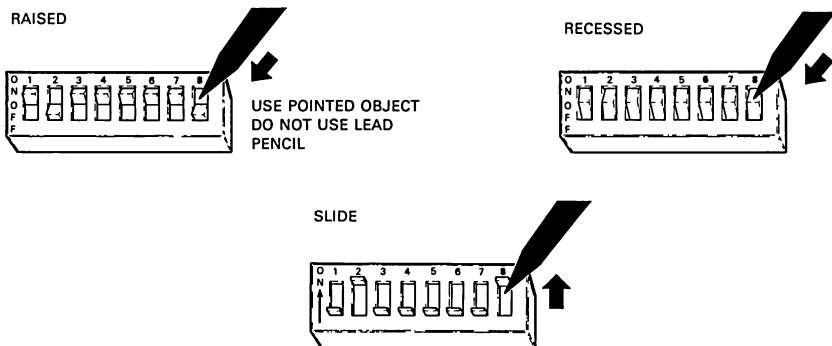
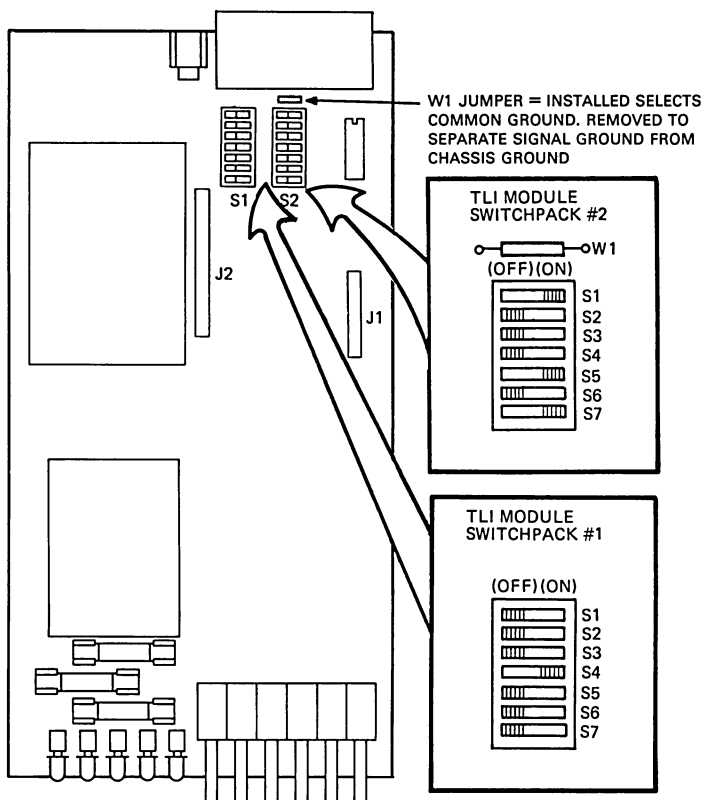


Figure 5-3 Switchpack Variations



MK-3446

Figure 5-4 Standalone DF03 Interface Board Layout (70-17298)

Table 5-3 Standalone Interface Module Switchpack 1 Selections

Option	Switch Jumper*	S2 W12	S3 W13	S4 W14	S5 W15	S6 W16	S7 W17
DF03-AA/AC Configuration†	AA (STD) AC (ACU)	Off On	Off On	On Off		Off On	
Interface Terminal Timing	Enabled Disabled				On Off		
Interface Speed Select	Enabled Disabled						On Off

NOTE: Standard factory configurations are printed in blue.

* On earlier versions, jumpers were used instead of switches. A jumper installed is the same as a switch on. A jumper out is the same as a switch off.

† The same option must be installed on Switchpack 2.

Table 5-4 Standalone Interface Module Switchpack 2 Selections

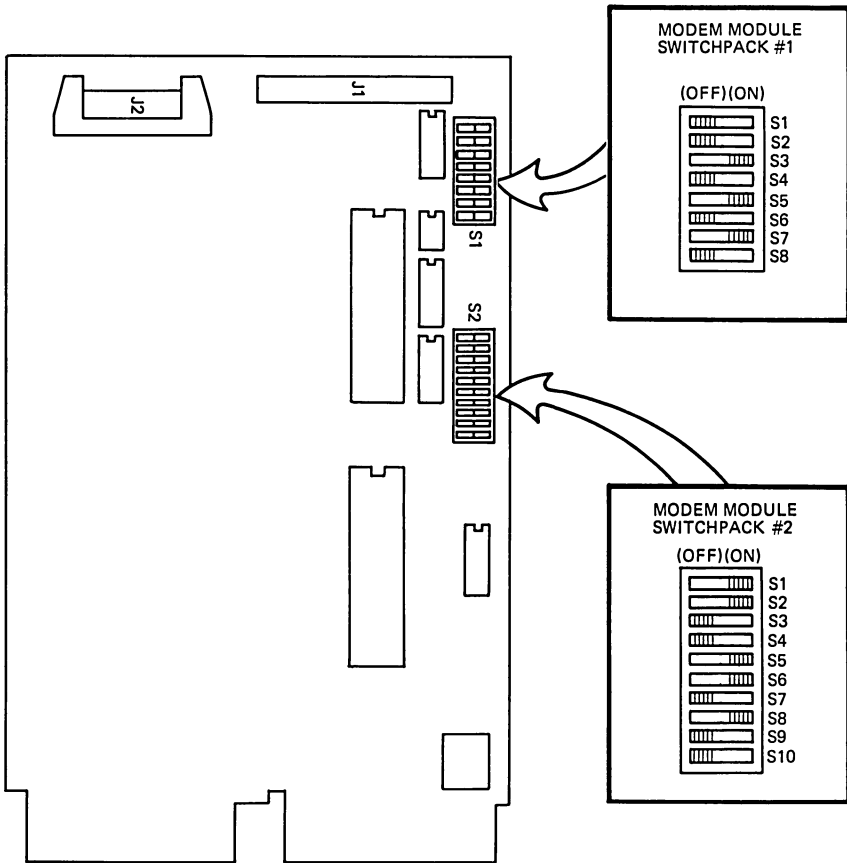
Option	Switch Jumper*	S1 W21	S2 W22	S3 W23	S4 W24	S5 W25	S6 W26	S7 W27
Interface Ring Indicate	Enabled Disabled	On Off						
Interface ANL Control	Enabled Disabled		On Off					
Interface RDL Control	Enabled Disabled			On Off				
DF03-AA/AC Configuration†	AA (STD) AC (ACU)				Off On			
Interface Speed Indicate	Normal Enabled Alternate Enabled Disabled					On Off Off	Off On Off	
Interface Test Mode Indicate	Enabled Disabled						On Off	

NOTE: Standard factory configurations are printed in blue.

* On earlier versions, jumpers were used instead of switches. A jumper installed is the same as a switch on. A jumper out is the same as a switch off.

† The same option must be installed on Switchpack 1.

5.4.1.2 Modem Board (M5800) – The Modem Board (M5800) contains two switchpacks (see Figure 5-5) to select certain options as specified in Tables 5-5 and 5-6.



MK-3447

a. Switchpack #1

Figure 5-5 Standalone DF03 Modem Board Layout (M5800) (Sheet 1 of 2)

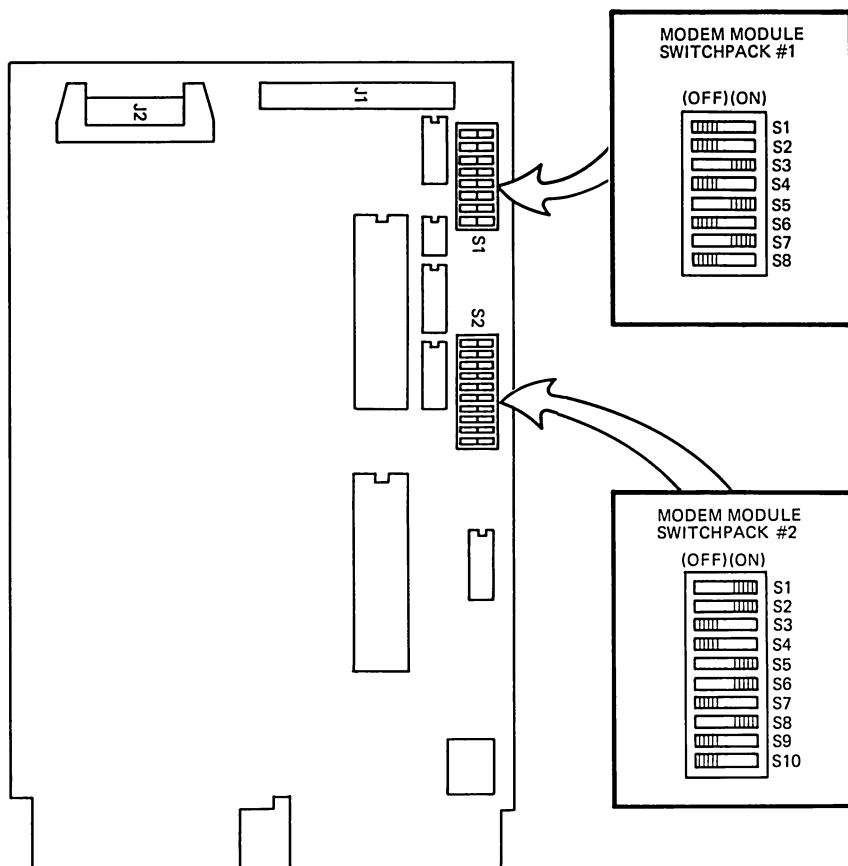
Table 5-5 Standalone Modem Module Switchpack 1 Selections

Option	Switch Jumper*	S1 W11	S2 W12	S3 W13	S4 W14	S5 W15	S6 W16	S7 W17	S8 W18
Receiver Timing†	Enabled Disabled	On Off							
Transmitter Timing†	Enabled Disabled		On Off						
Interface Speed Indicate	Enabled Disabled			On Off					
Terminal Timing	Enabled Disabled Slave				Off Off On	On Off Off			
Mode†	Async Sync						Off On		
Character Length	9 Bits 10 Bits							Off On	
Receiver Responds to RDL	Enabled Disabled								Off On

NOTE: Standard factory configurations are printed in blue.

* On earlier versions, jumpers were used instead of switches. A jumper installed is the same as a switch on. A jumper out is the same as a switch off.

† These options must be set opposite to the standard factory settings for synchronous 1200 b/s operation.



MK-3447

b. Switchpack #2

Figure 5-5 Standalone DF03 Modem Board Layout (M5800) (Sheet 2 of 2)

Table 5-6 Standalone Modem Module Switchpack 2 Selections

Option	Switch Jumper*	S1 W21	S2 W22	S3 W23	S4 W24	S5 W25	S6 W26	S7 W27	S8 W28	S9 W29	S10 W30
Loss of Carrier Disconnect	Enabled Disabled	On Off									
Send Space Disconnect†	Enabled Disabled		On Off								
Auto Answer	Enabled Disabled			Off On							
Speed	Dual High Only				Off On						
DSR Indication in ANL (NOTE)	Enabled Disabled					On Off					
Long Space Disconnect†	Enabled Disabled						On Off				
CTS, CAR Detect Interface Indication	Common Separate							On Off			
CAR Detect Interface Indication	Normal Forced								On Off		
DSR Interface Indication	Normal Forced									Off On	
CTS Interface Indication	Normal Forced										Off On

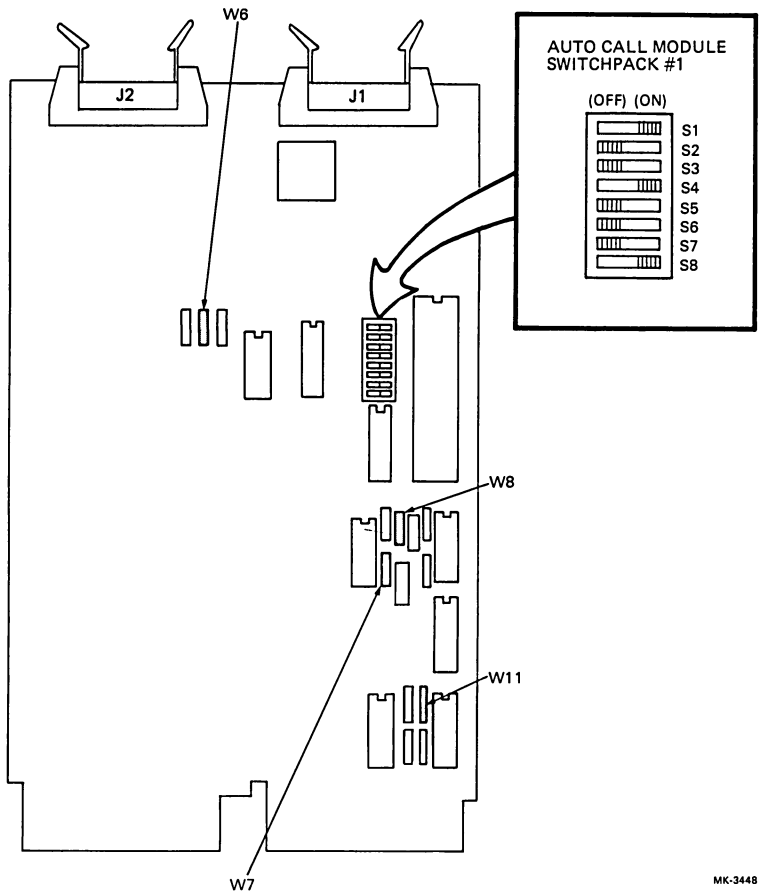
NOTE: When selecting options on the modem board, the DSR indication in ANL cannot be selected with the DSR interface indication.

NOTE: Standard factory configurations are printed in blue.

* On earlier versions, jumpers were used instead of switches. A jumper installed is the same as a switch on. A jumper out is the same as a switch off.

† These options must be set opposite to the standard factory settings for synchronous 1200 b/s operation.

5.4.1.3 Standalone Auto Call Board (M7177) – The DF03 Auto Call Board (M7177) contains only one switchpack and four jumpers to select certain options. Refer to Figure 5-6 for component locations and to Tables 5-7 and 5-8 for specific options selections.



MK-3448

Figure 5-6 DF03 Auto Call Board Layout (M7177)

Table 5-7 Standalone DF03 Auto Call Board Jumpers

Jumper Options	Selection	W6	W7	W8	W11
Local Copy	Enable Disable	In Out			
Dialer Speed	10 Pulses/s 20 Pulses/s		In Out	Out In	
Answer Tone Abort Timer	27 Sec 52 Sec				In Out

NOTE: Standard factory configurations are printed in blue.

Table 5-8 Standalone DF03 Auto Call Board Switchpack 1 Selections

Switch Option	Selection	S1	S2	S3	S4	S5	S6	S7	S8
Parity Type	Even Enable Odd Enable	Off On							
Character Length	7 Bits 8 Bits		On Off	Off Off					
Stop Bit Select	2 Stop Bits 1 Stop Bit				Off On				
Parity Select	Enable Inhibit					On Off			
Communication Bit Rate	110 b/s 300 b/s 1200 b/s* Auto Select†						On Off Off Off	Off On Off Off	Off Off On Off

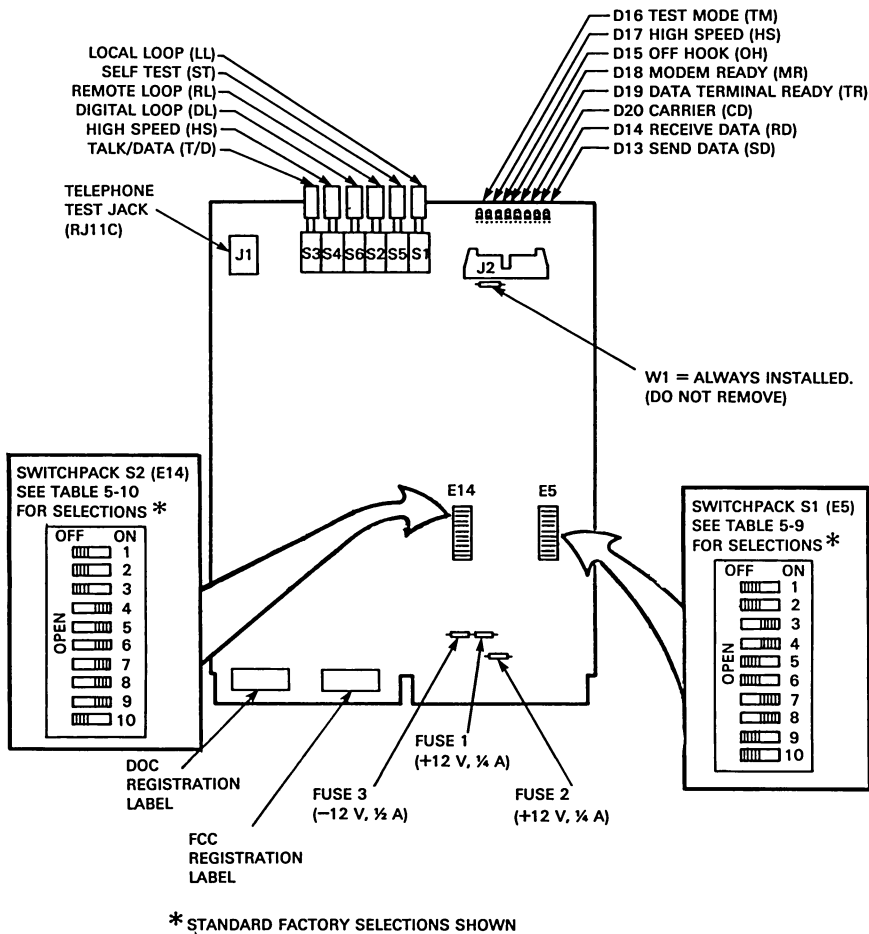
NOTE: Standard factory configurations are printed in blue.

* Standard setting for the DF03-AC.

† Standard setting for the DF03-RC.

5.4.2 Rack Mount DF03 Options

5.4.2.1 Modem Board DF03-RA – The rack modem board contains two switchpacks and one jumper to select certain options. Figure 5-7 shows the location of the switchpacks and jumper as well as other components such as LEDs, pushbutton switches, and dc line fuses. Tables 5-9 and 5-10 list each option and switchpack configuration to implement those options.



MX-4186

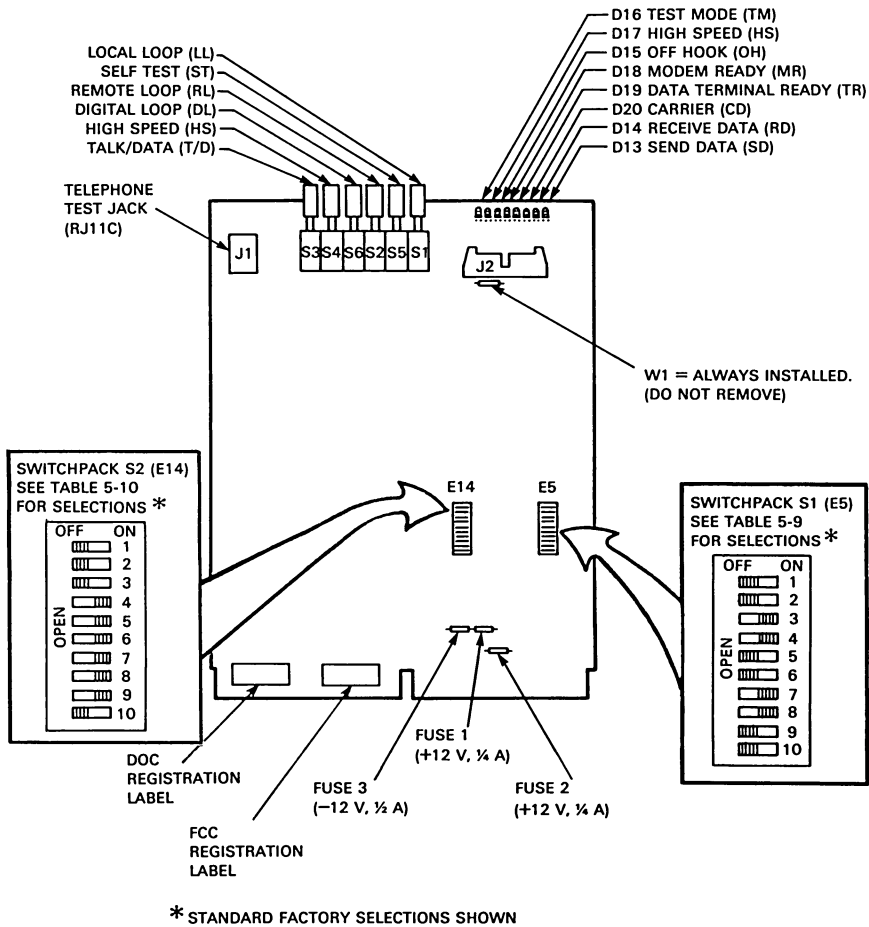
a. Switchpack #1

Figure 5-7 Rack Mount DF03 Modem Board Layout (DF03-RA) (Sheet 1 of 2)

Table 5-9 Rack Mount Modem Board Switchpack 1 Selections

Option	Configu- ration	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Terminal Timing	Disabled Enabled Slave	Off On Off	Off Off On								
Loss of Carrier Disconnect	Disabled Enabled			Off On							
Character Length	9 Bits 10 Bits				Off On						
Respond to RDL	Enabled Disabled					Off On					
Auto Answer	Enabled Disabled						Off On				
Interface Speed Indication	Enabled Disabled							On Off			
DSR Indication in ANL	Enabled Disabled								On Off		
Speed	Dual High Speed Only									Off On	
CTS, CAR Detect Interface Indication	Separate Common										Off On

NOTE: Standard factory configurations are printed in blue.



MK-4186

b. Switchpack #2

Figure 5-7 Rack Mount DF03 Modem Board Layout (DF03-RA) (Sheet 2 of 2)

Table 5-10 Rack Mount Modem Board Switchpack 2 Selections

Option	Configuration	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Mode*	Async Sync	Off On									
Modem Receiver Timing*	Enabled Disabled		On Off								
Modem Transmit Timing*	Enabled Disabled			On Off							
Send Space Disconnect*	Enabled Disabled				On Off						
Long Space Disconnect*	Enabled Disabled					On Off					
Interface Test Mode Indicate	Enabled Disabled						On Off				
Open REC Data ACU Only	Normal ACU							On Off			
Interface Speed Select	Enabled Disabled								On Off		
Transmit Level Normal†	Enabled Disabled									On Off	
Transmit Level Programmed†	Enabled Disabled										On Off

NOTE: Standard factory configurations are printed in blue.

* These options must be set opposite to the standard factory settings for synchronous 1200 b/s operation.

† These switches must be set opposite; that is, only one may be enabled, the other must be disabled.

5.4.2.2 Rack Mount Auto Call Board (M7177) – The rack mount M7177 auto call module is exactly the same as the M7177 module used on the standalone DF03; the only difference is the revision level of the board. The M7177 module must be at REV LEVEL F or later for use with the rack mounted DF03; any REV LEVEL M7177 can be used on the standalone unit. In order to allow the rack modems to automatically control the auto call speed, selection switches S6, S7, and S8 must be set to the OFF position. This enables the Auto Select Speed feature. For switchpack location, see Figure 5-6. Refer to Tables 5-7 and 5-8 for specific option selections and to Table 5-2 for detailed option descriptions.

5.5 DF03 REASSEMBLY

5.5.1 Standalone DF03 Reassembly

Reassembly procedures for the DF03-AA and DF03-AC are identical; follow the simple procedures in Figure 5-8. Remember, the DF03-AC has three PCBs; the DF03-AA has only two.

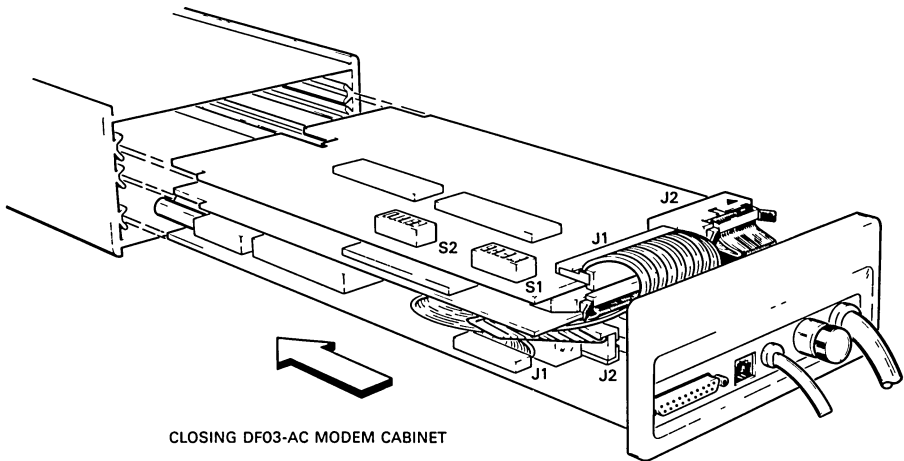


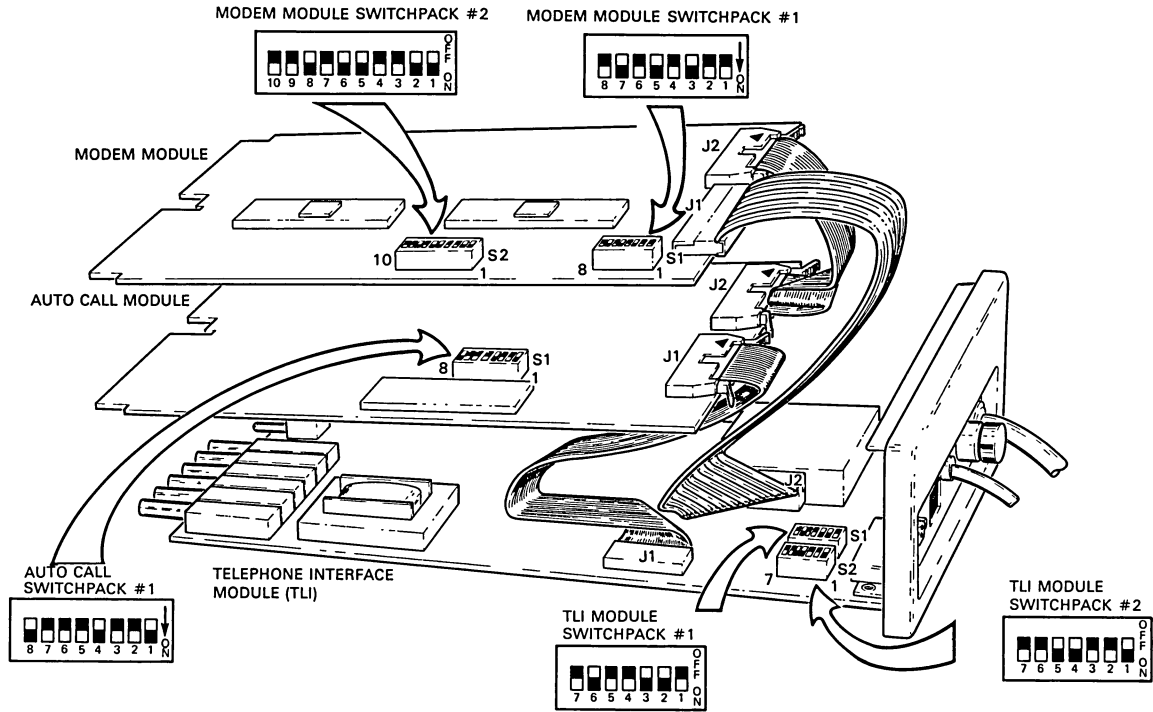
Figure 5-8 Standalone DF03 Reassembly

1. Verify that all cables are correctly connected (see Figure 5-9 or 5-10)
2. Insert modem board in top guide.
3. Insert ACU board in center guide.
4. Insert interface board in bottom guide.

5. Slide all boards into case. Secure with screws and lock washers removed earlier.
6. Run modem tests to verify that the unit is operational.

5.5.2 Rack Mount DF03 Reassembly

After inserting a module or verifying switchpacks and/or jumpers, reassemble the rack mount unit as specified in Figure 5-11.

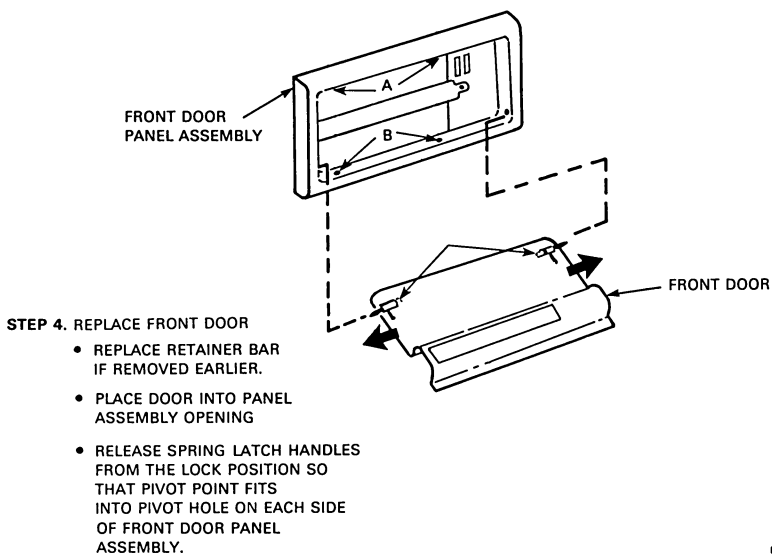
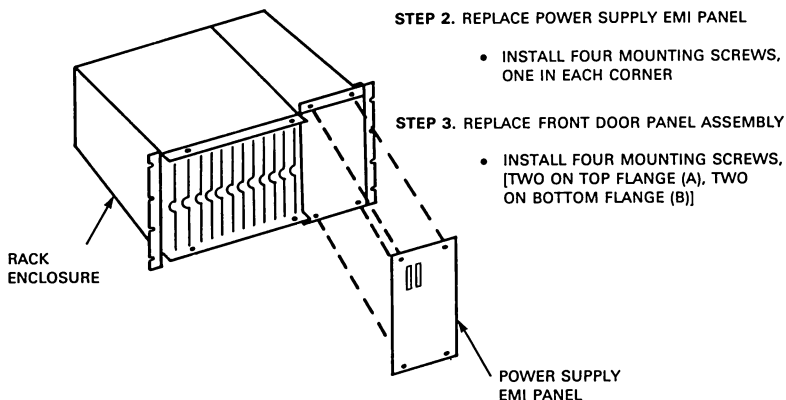


MK-4290

Figure 5-10 Standalone DF03-AC Cabling

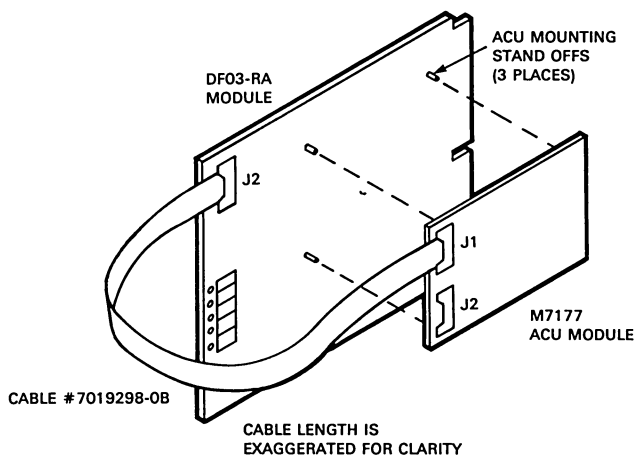
STEP 1. MODULE CHECK

- IF M7177 ACU MODULES ARE INSTALLED, VERIFY THAT CABLE #7019298-08 IS CORRECTLY CONNECTED (SEE FIGURE 5-12)
- IF BACKUP POWER SUPPLY REGULATOR BOARD IS BEING INSTALLED OR ONE OF TWO BOARDS WAS REPLACED, VERIFY THAT CABLE #7019305-XX IS CORRECTLY CONNECTED (SEE FIGURE 5-13)



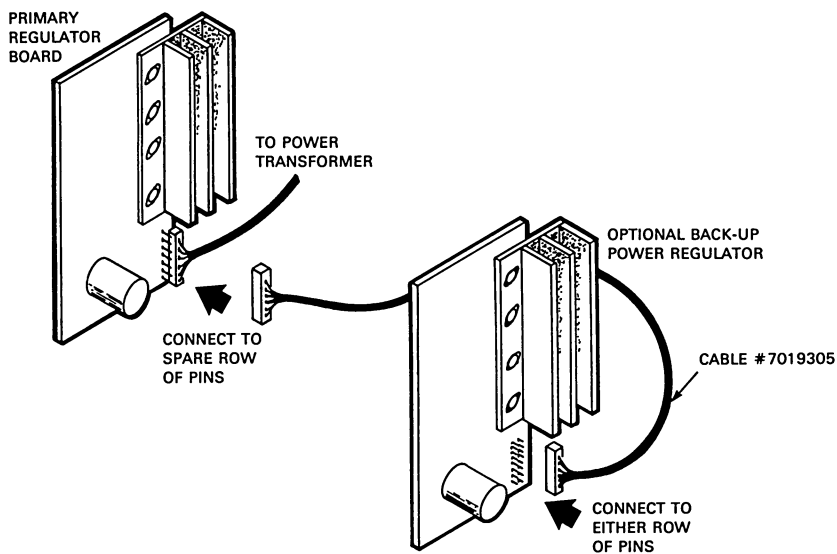
MK-4183

Figure 5-11 Rack Mount DF100-RM Reassembly



MK-4178

Figure 5-12 DF03-RA to M7177 Interconnect Cabling



MK-4179

Figure 5-13 Dual Power Supply PCB Interconnect Cabling

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CHAPTER 6 SERVICE

6.1 GENERAL

The DF03 is registered with the Federal Communications Commission for direct connection to the telephone network. The regulations require that all repairs on the DF03 modem modules be performed by Digital Equipment Corporation or its authorized agent.

6.2 DF03 SERVICE

If the DF03 is inoperative, contact a DIGITAL representative for information about system service.

6.3 TELEPHONE COMPANY SERVICE OR EQUIPMENT PROBLEMS

Problems encountered with the telephone company equipment or service must be reported immediately to the telephone company. It is important, however, to first make certain that the problem is with the telephone company equipment and not with the customer's equipment. Interfacing between the DF100-RM and the telephone line is accomplished through the DF100-RM rear panel connector J13. Refer to Table D-1, in Appendix D, for the TIP and RING pin assignments for each line.

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APPENDIX A

QUICK REFERENCE GUIDE

The DF03 Quick Reference provides summary information on the positions of all pushbuttons and the conditions of all LEDs for the DF03 tests. Refer to this summary when performing test procedures.

DF03 QUICK REFERENCE

Analog Loopback Selftest

1. All pushbuttons "OUT"
2. CAR and DSR "OFF"
3. HS – speed as required
4. ANL(LL) and ST "IN"
5. CAR "ON" for at least one minute
6. Terminate – ANL and ST "OUT"

Analog Loopback Test

1. All pushbuttons "OUT"
2. DTR "ON", CAR and DSR "OFF"
3. HS – speed as required
4. ANL(LL) "IN", TEST "ON"
5. CAR "ON" (within three seconds)
6. Enter data by terminal or CPU
7. Terminate – ANL "OUT"

Remote Digital Loopback Selftest (High Speed)

1. DTR "ON"
2. ANL and DTL "OUT"
3. ST, RDL, HS, and DATA/TALK "IN"
4. Dial remote location
5. After hearing answer tone – DATA/TALK "OUT"
6. CAR, HS, and TEST "ON"
7. CAR "ON" (at least two minutes)
8. Terminate – ST "OUT", DATA/TALK "IN"

Remote Digital Loopback Test (High Speed)

1. DTR "ON"
2. ANL, ST, and DTL "OUT"
3. RDL, HS, and DATA/TALK "IN"
4. Dial remote location
5. After hearing answer tone – DATA/TALK "OUT", hang up phone
6. CAR, DSR, HS, and TEST "ON"
7. Enter data by terminal or CPU
8. Terminate – DATA/TALK "IN"

Full-Duplex End-to-End Selftest

1. Establish voice communications with remote station
2. ANL, ST, RDL, and DTL "OUT"
3. HS – speed as required
4. ST "IN" (at both locations)
5. DATA/TALK "IN"
6. Dial remote station
7. After hearing answer tone – DATA/TALK "OUT"
8. CAR, DSR, and TEST "ON" (at both locations), HS "ON" (if in high speed)
9. Terminate – ST "OUT", DATA/TALK "IN" (at both locations)

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APPENDIX B

PROGRAMMING EXAMPLES

FOR AUTO CALL

This appendix contains programming examples to control the DF03 Auto Call Unit. Example 1 demonstrates a possible approach in BASIC, and Example 2 shows another approach using VMS.

Various techniques and other approaches are possible and are only limited by the designer's imagination and the fundamentals of the calling sequence.

EXAMPLE 1

DIAL.BAS

```

10  EXTEND
20  !
    ! This program uses the DF02-AC or DF03-AC/RC to dial out to a
    ! remote system. Nothing occurs after the dial is complete
    ! and the user may then run another program to use the dialed
    ! up keyboard to simulate a "virtual terminal" connection.
    ! NOTE - the keyboard to which the DF02/03 modem is connected
    ! must have had the speed set using the /RING option as described
    ! in the RSTS/E System Manager's Manual.
    !
100 DIM TELNO%(32%),R%(30%) &
    ! TELNO%      TELEPHONE STRING CONVERSION &
    ! R%          RESPONSE IN BINARY          &

200 INPUT "Enter Keyboard number of dial port";KB%
210 INPUT "Enter telephone number";TELNO$
220 GOSUB 11000 ! CHECK TELEPHONE NUMBER & KEYBOARD
225 IF LEN(E$) <> 0 THEN GOTO 395
226 STR$ = CHR$(6%)+
    CHR$(10%)+
    STRING$(20%,0%)+
    "KB"+
    CHR$(KB%)+
    CHR$(255%)
227 S$ = SYS(STR$)
230 KB$ = "KB"+NUM1$(KB%)+": "
235 OPEN DEV$ AS FILE 1%, MODE 1%
240 S$ = FNHANGUP$(KB%) ! HANG UP OLD PHONE CONNECTION

```

```

250 S% = FNSETDTR%(KB%) ! SET DTR
300 STX$ = CHR$(128%+1)+CHR$(128%+2%) ! Control/A + Control/B
310 DIAL$ = STX$+TELNO$
320 ON ERROR GOTO 380 &
  \ PRINT #1%, DIAL$ &

340 PRINT "WAITING FOR RESPONSE (";DIAL$;")" &

347 TRY% = 0%

350 ON EROR GOTO 380 &
  \ GOSUB 12000 UNTIL R$ <> ""

360 GOTO 370 IF R$<>"A"

365 PRINT "CALL COMPLETE" &
  \ GOTO 400

370 E$ = "BAD RESPONSE = "+R$ $
  \ E$ = "NO ANSWER TONE" IF R$="B" &
  \ E$ = "PROCEDURE ERROR" IF R$="G" &
  \ GOTO 390

380 IF TRY% < 30% THEN GOTO 382
381 R$ = "A" &
  \ RESUME 12500

382 IF ERR = 13% AND ERL = 12200 THEN RESUME 12200
  \ R$ = NUM1$(ERR) $
  \ RESUME 12500

384 R$ = "Device detached" &
  \ RESUME 12500

385 E$ = "" &
  \ E% = ERR &
  \ E$ = "KEYBOARD BUSY" IF E%=8% AND ERL 227 &
  \ E$ = "NO RESPONSE" IF E%=15% AND ERL=350 &
  \ E$ = "ERR = "+NUM1$(E%)+ " AT LINE "+NUM1$(ERL) UNLESS LEN(E$) &
  \ RESUME 390

390 S% = FNHANGUP%(KB%)

395 PRINT E$

400 ON ERROR GOTO 0 &
  \ CLOSE 1% &
  \ GOTO 32767

11000 !&
  &
  ! TELEPHONE NUMBER AND KEYBOARD NUMBER SUBROUTINE &

11100 L% = LEN(TELNO$) &
  \ GOTO 11200 IF L% <= 32% &
  \ E$ = "TELEPHONE NUMBER TOO LONG" &
  \ GOTO 11200

11200 CHANGE TELNO$ TO TELNO% &
  \ FOR I%=1% TO L% &

```

```

11210 T%=TELNO%(I%) &
      \ GOTO 11230 IF T% >= ASCII("0") AND T% <= ASCII("9") &
      \ GOTO 11230 IF T% = ASCII("=") &
          ! ACCEPT DIGITS 0 TO 9 &
          ! RETAIN ACCESS PAUSE = &

11220 E$ = "BAD TELEPHONE NUMBER" &
      \ GOTO 11260 &

11230 NEXT I% &
      \ CHANGE TELNO% TO TELNO$ &
      \ TELNO$ = CVT$$ (TELNO$,4%) &

11240 GOTO 11250 IF KB% > 128% &
      \ DEV$ = "KB"+NUM1$ (KB%)+":" &
      \ GOTO 11260 &

11250 E$ = "BAD KEYBOARD NUMBER" &

11260 RETURN

12000 !
      ! SUBROUTINE TO GET NEXT CHARACTER
      !
      &
      &
      &

12100 IF LEN(BUFFER$) > 0 THEN 12300
12200 OPEN DEV$ AS FILE 1%, MODE 1% &
      \ TRY% = TRY% + 1% &
      \ SLEEP 1% &
      \ GET #1%, RECORD 8192% &
      \ FIELD #1%, RECOUNT AS BUFFER$

12300 R$ = CVT$$ (LEFT (BUFFER$,1%),1%)
12400 BUFFER$ = RIGHT (BUFFER$,2%)
12500 RETURN

18000 !&
      &
      ! FUNCTIONS &

18100 DEF* FNHANGUP%(KB%) &
      \ Z$ = SYS (CHR$ (6%)+CHR$ (-9%)+CHR$ (KB%)+CHR$ (0%)) &
      \ SLEEP 7% &
      \ FNEND &

18200 DEF* FNSETDTR%(KB%) &
      \ Z$ = SYS (CHR$ (6%)+CHR$ (-9%)+CHR$ (KB%)=CHR$ (-1%)) &
      \ FNEND &

32767 END

Ready

```

EXAMPLE 2

```

C      VMS demonstration of DF03 autodial and software disconnect
C      Digital Equipment Corporation          January 1983
C      Beware; This program is a demo, not a product; it can cause
C      strange side effects. Error handling is rudimentary.

PARAMETER      OK = 1          ! for documentation clarity
INTEGER*2      MODEM_CHANNEL   ! handle for explicit QIO's
INTEGER*2      STATUS         ! for system service results
CHARACTER*12    PHONE_NUMBER   ! digit string; maybe with "="
CHARACTER*5     MODEM_NAME     ! the outgoing VMS device
CHARACTER*1     ANSWER        ! response from the DF03
CHARACTER*6     FORTRAN_UNIT   ! for generally easy I/O
DATA            FORTRAN_      /'FOR040'/      ! quite arbitrary
EXTERNAL        SYS$QIOW,SYS$ASSIGN,SYS$CRELOG ! system services
INTEGER*4       SYS$QIOW,SYS$ASSIGN,SYS$CRELOG ! this is needed
EXTERNAL        IO$ SETMODE,IO$M HANGUP      ! QIO arguments
EXTERNAL        IO$_TTYREADALL,IO$_NOECHO     ! QIO arguments

C      Get the line name and associate a channel and unit with it
TYPE '(' VAX line name: '$)'
ACCEPT '(A5)',MODEM_NAME          ! example: TTB2:
MODEM_NAME(5:5) = ':'           ! to get a device, not a file name

C      Equate to FORTRAN unit for easy reference
STATUS = SYS$CRELOG(%VAL(2),FORTRAN_UNIT,MODEM_NAME,)
IF (STATUS .NE. OK) TYPE *, 'EQUATE FAILED, STATUS=',STATUS

C      Assign a channel for an eventual disconnect command
STATUS = SYS$ASSIGN(FORTRAN_UNIT,MODEM_CHANNEL,,)
IF (STATUS .NE. OK) TYPE *, 'ASSIGNMENT FAILED. STATUS=',STATUS

C      Now get the outgoing number as a string of digits
TYPE '(' DIGITS TO BE DIALED = '$)'
ACCEPT '(Q,A)', LENGTH,PHONE_NUMBER
IF (LENGTH .GT. 11) TYPE *, 'NUMBER TOO LONG; TRUNCATED.'
LENGTH = MIN(LENGTH,12)

C      Dial it
WRITE (40,*) CHAR(2)//PHONE_NUMBER(1:LENGTH) ! note ^B prefix
READ (40,('(A1)') ANSWER ! get DF03 autocall status; however,
a FORTRAN READ would wait for a carriage return; use a QIO call
STATUS = SYS$QIOW( , %VAL(MODEM_CHANNEL),
1          %VAL(JIEOR(%LOC(IO$_TTYREADALL),%LOC(IO$_NOECHO))),,,
2          %REF(ANSWER),%VAL(1),,,) ! read a solitary byte
IF (STATUS .NE. OK) TYPE *, 'RESPONSE ERROR: ',STATUS
C      IF (ANSWER .NE. 'A') TYPE *, 'DIALING NOT SUCCESSFUL.',ANSWER

WRITE (40,*) ' this should type out on the remote terminal'

C      Disconnect the telephone line to the remote terminal
STATUS = SYS$QIOW( , %VAL(MODEM_CHANNEL),
1          %VAL(JIEOR(%LOC(IO$_SETMODE),%LOC(IO$_HANGUP))),
2          , , , , , ) ! optional arguments omitted

IF (STATUS .EQ. OK) TYPE *, 'DISCONNECTED'

END

```

APPENDIX C
EIA DATA

The connector pin numbers and associated circuit designations for the DF03 modem are listed in Table C-1. All circuits are defined by EIA RS-232-C except those designated by a dagger (†). The circuits designated by a dagger are defined by CCITT V.24.

The customer interface circuit designators are listed below for both EIA and CCITT designators.

NOTE
Data terminal equipment can be a computer or a data terminal.

EIA Signals	
AA	Protective Ground – Circuit 1 Ground is common to the ac power service ground.
AB	Signal Ground (Common Return) – Circuit 7 This circuit establishes the common ground reference for all interface circuits.
BA	Transmitted Data – Circuit 2 The transmit data signal is serial data input from the Data Terminal Equipment (DTE). This circuit is driven by the terminal equipment and held in a marking condition during intervals between characters or words and, at times, when no data is being transmitted.

EIA Signals (Cont)

BB Received Data – Circuit 3

Serial binary data on this circuit is generated by the modem (DCE) in response to signals received on the phone lines. Received data is held in the marking condition whenever the received line signal detector is in the OFF condition.

CB Clear to Send – Circuit 5

This signal is generated by the modem (DCE) to indicate to the Data Terminal Equipment (DTE) that the modem is ready to transmit data.

CC Data Set Ready – Circuit 6

This signal is generated by the modem (DCE) and sent to the Data Terminal Equipment (DTE) to indicate that the modem is not in the test mode and is off-hook, except in the analog loop test mode option is installed.

CD Data Terminal Ready – Circuit 20

This circuit indicates to the modem (DCE) that the Data Terminal Equipment (DTE) is ready for use. This signal, in combination with a ringing indication, connects the modem to the telephone line. An OFF condition causes the modem to disconnect.

CE Ring Indicator – Circuit 22

This circuit indicates a ring condition was detected by the modem (DCE) and sent to the Data Terminal Equipment (DTE).

CF Received Line Signal Detector – Circuit 8

This signal is true when the modem is receiving a signal capable of being demodulated. The received signal must meet all of the quality criteria of frequency, voltage levels, and signal-to-noise ratio. A not-true condition of this signal causes the received data output to be clamped in the marking or OFF state. This signal becomes true 155 ms after detecting an acceptable carrier. Seventeen milliseconds after the carrier is absent or no longer acceptable, this signal becomes false.

CH Data Rate Select – Circuit 23

EIA Signals (Cont)

	This circuit is used to allow the Data Terminal Equipment (DTE) to select high-speed or low-speed operation. The speed mode of the answering station is automatically determined from the line signal and the rate selector is ignored. When circuit is active (high) high speed is selected.
DA	Transmitter Signal Element Timing [External Data Terminal Equipment (DTE) Source] – Circuit 24 This circuit is used when signal element timing information is selected and the high-speed mode (1200 b/s) with synchronous format is used. Timing must be provided by an external clock source on EIA Pin 24.
DB	Transmitter Signal Element Timing [Data Communications Equipment (DCE) Source] – Circuit 15 This circuit is associated with the high-speed synchronous format and operates in conjunction with transmitted data (BA). The timing signal is generated from the internal modem clock source.
(DD)	Receiver Signal Element Timing [Data Communications Equipment (DCE) Source] – Circuit 17 This circuit is associated only with the synchronous format in the high-speed mode and works in conjunction with the received data (BB) circuit.

CCITT Signals

CI Speed Mode Indicate – Circuit 12 (Alternate Circuit 11)

This circuit is in the ON state when the modem is in the high-speed data mode or the high-speed analog loop test mode. At all other times, the CI circuit is in the OFF state. The state of the CI interface circuit does not necessarily correspond with the state of the speed select (HS) pushbutton. This is true since the answering modem automatically adapts to the speed of the originating station each time the data mode is entered, ignoring its own speed selector.

LL* Analog Loop Select – Circuit 18

When asserted by the Data Terminal Equipment (DTE), the analog loop select option is selected. This circuit allows an analog loop test mode to be selected by the Data Terminal Equipment (DTE).

RL* Remote Digital Loop Select – Circuit 21

When asserted by the Data Terminal Equipment (DTE), the remote digital loop select option is selected. This circuit permits a remote digital loop test mode to be selected by the DTE.

TM* Test Mode Indicate – Circuit 25

This circuit is asserted by the modem (DCE) when the interface test mode indicate option is selected. This circuit indicates to the DTE that the modem is in a test mode.

* Circuits not defined by EIA RS-232-C.

Table C-1 Interface Pin Assignments

Pin	EIA/CCITT Designation	EIA/CCITT Function
1	AA	Protective Ground*
2	BA	Transmitted Data*
3	BB	Received Data*
4	–	Not Used
5	CB	Clear-to-send
6	CC	Data Set Ready
7	AB	Signal Ground*
8	CF	Received Line Signal Detector
9	–	Positive Test Voltage (+12V)
10	–	Negative Test Voltage (–12V)
11	CI(Alt)†	Alternate CI Indicate
12	CI	Speed Mode Indicate
13	–	Not Used
14	–	Not Used
15	DB	Internal Transmit Signal Element Timing (Internal)
16	–	Not Used
17	DD	Receive Signal Timing
18	LL†	Analog Loopback Select
19	–	Not Used
20	CD	Data Terminal Ready*
21	RL†	Remote Digital Loopback Select
22	CE	Ring Indicator
23	CH	Data Rate Selector
24	DA	External Transmit Signal Element Timing (External)
25	TM†	Make Busy/Test Mode Indicate

* Required MINIMUM Customer Controlled Interface Circuits

† Defined by CCITT V.24

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APPENDIX D RJ21X SIGNAL CONNECTIONS TO CONNECTOR J13

Table D-1 identifies the TIP and RING connections for the rack mount modem rear panel connector J13.

NOTE

- 1. J13 is a 50 pin connector that can accommodate 25 wire pairs; however, only the first 12 wire pairs are connected.**
- 2. These pin assignments comply with U.S. Universal Service Order Code RJ21X and Canadian Type O service.**

Table D-1 Telephone Connector (J13) Pin Usage

Line	RING Signal	TIP Signal
1	PIN 1	PIN 26
2	PIN 2	PIN 27
3	PIN 3	PIN 28
4	PIN 4	PIN 29
5	PIN 5	PIN 30
6	PIN 6	PIN 31
7	PIN 7	PIN 32
8	PIN 8	PIN 33
9	PIN 9	PIN 34
10	PIN 10	PIN 35
11	PIN 11	PIN 36
12	PIN 12	PIN 37

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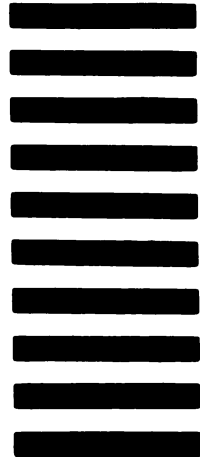
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